# Northeastern College

January 1919

## CATALOG

of the

## Co-operative School of Engineering



1919-1920



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THE ASSOCIATION BUILDING
HOME OF NORTHEASTERN COLLEGE

# Northeastern College

## CATALOG

of the

# Co-operative School of Engineering


1919-1920

316 Huntington Avenue
BOSTON, MASSACHUSETTS

# YEARLY CALENDAR

## 1919

### JANUARY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | .. | *1* | 2 | 3 | 4 |
| *5* | 6 | 7 | 8 | 9 | 10 | 11 |
| *12* | 13 | 14 | 15 | 16 | 17 | 18 |
| *19* | 20 | 21 | 22 | 23 | 24 | 25 |
| *26* | 27 | 28 | 29 | 30 | 31 | .. |
| .. | .. | .. | .. | .. | .. | .. |

### FEBRUARY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | .. | .. | .. | 1 |
| *2* | 3 | 4 | 5 | 6 | 7 | 8 |
| *9* | 10 | 11 | 12 | 13 | 14 | 15 |
| *16* | 17 | 18 | 19 | 20 | 21 | *22* |
| *23* | 24 | 25 | 26 | 27 | 28 | .. |
| .. | .. | .. | .. | .. | .. | .. |

### MARCH

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | .. | .. | .. | 1 |
| *2* | 3 | 4 | 5 | 6 | 7 | 8 |
| *9* | 10 | 11 | 12 | 13 | 14 | 15 |
| *16* | 17 | 18 | 19 | 20 | 21 | 22 |
| *23* | 24 | 25 | 26 | 27 | 28 | 29 |
| *30* | 31 | .. | .. | .. | .. | .. |

### APRIL

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | 1 | 2 | 3 | 4 | 5 |
| *6* | 7 | 8 | 9 | 10 | 11 | 12 |
| *13* | 14 | 15 | 16 | 17 | 18 | *19* |
| *20* | 21 | 22 | 23 | 24 | 25 | 26 |
| *27* | 28 | 29 | 30 | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |

### MAY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | .. | 1 | 2 | 3 |
| *4* | 5 | 6 | 7 | 8 | 9 | 10 |
| *11* | 12 | 13 | 14 | 15 | 16 | 17 |
| *18* | 19 | 20 | 21 | 22 | 23 | 24 |
| *25* | 26 | 27 | 28 | 29 | *30* | 31 |
| .. | .. | .. | .. | .. | .. | .. |

### JUNE

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| *1* | 2 | 3 | 4 | 5 | 6 | 7 |
| *8* | *9* | *10* | *11* | *12* | *13* | *14* |
| *15* | *16* | *17* | *18* | *19* | *20* | *21* | *22* |
| *15* | *16* | *17* | *18* | *19* | *20* | *21* |
| *22* | *23* | *24* | *25* | *26* | *27* | *28* |
| *29* | *30* | .. | .. | .. | .. | .. |

### JULY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | *1* | *2* | *3* | *4* | *5* |
| *6* | *7* | *8* | *9* | *10* | *11* | *12* |
| *13* | *14* | *15* | *16* | *17* | *18* | *19* |
| *20* | *21* | *22* | *23* | *24* | *25* | *26* |
| *27* | *28* | *29* | *30* | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |

### AUGUST

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | .. | .. | *1* | *2* |
| *3* | *4* | *5* | *6* | *7* | *8* | *9* |
| *10* | *11* | *12* | *13* | *14* | *15* | *16* |
| *17* | *18* | *19* | *20* | *21* | *22* | *23* |
| *24* | *25* | *26* | *27* | *28* | *29* | *30* |
| *31* | .. | .. | .. | .. | .. | .. |

### SEPTEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | *1* | *2* | *3* | *4* | *5* | *6* |
| *7* | 8 | 9 | 10 | 11 | 12 | 13 |
| *14* | 15 | 16 | 17 | 18 | 19 | 20 |
| *21* | 22 | 23 | 24 | 25 | 26 | 27 |
| *28* | 29 | 30 | .. | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |

### OCTOBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | 1 | 2 | 3 | 4 |
| *5* | 6 | 7 | 8 | 9 | 10 | 11 |
| *12* | 13 | 14 | 15 | 16 | 17 | 18 |
| *19* | 20 | 21 | 22 | 23 | 24 | 25 |
| *26* | 27 | 28 | 29 | 30 | 31 | .. |
| .. | .. | .. | .. | .. | .. | .. |

### NOVEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | .. | .. | .. | 1 |
| *2* | 3 | 4 | 5 | 6 | 7 | 8 |
| *9* | 10 | 11 | 12 | 13 | 14 | 15 |
| *16* | 17 | 18 | 19 | 20 | 21 | 22 |
| *23* | 24 | 25 | 26 | 27 | 28 | 29 |
| *30* | .. | .. | .. | .. | .. | .. |

### DECEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | 1 | 2 | 3 | 4 | 5 | 6 |
| *7* | 8 | 9 | 10 | 11 | 12 | 13 |
| *14* | *15* | *16* | *17* | *18* | *19* | *20* |
| *21* | *22* | *23* | *24* | *25* | *26* | *27* |
| *28* | 29 | 30 | 31 | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |

## 1920

### JANUARY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | .. | *1* | 2 | 3 |
| *4* | 5 | 6 | 7 | 8 | 9 | 10 |
| *11* | 12 | 13 | 14 | 15 | 16 | 17 |
| *18* | 19 | 20 | 21 | 22 | 23 | 24 |
| *25* | 26 | 27 | 28 | 29 | 30 | 31 |
| .. | .. | .. | .. | .. | .. | .. |

### FEBRUARY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| *1* | 2 | 3 | 4 | 5 | 6 | 7 |
| *8* | 9 | 10 | 11 | 12 | 13 | 14 |
| *15* | 16 | 17 | 18 | 19 | 20 | 21 |
| *22* | 23 | 24 | 25 | 26 | 27 | 28 |
| *29* | .. | .. | .. | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |

### MARCH

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | 1 | 2 | 3 | 4 | 5 | 6 |
| *7* | 8 | 9 | 10 | 11 | 12 | 13 |
| *14* | 15 | 16 | 17 | 18 | 19 | 20 |
| *21* | 22 | 23 | 24 | 25 | 26 | 27 |
| *28* | 29 | 30 | 31 | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |

### APRIL

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | .. | 1 | 2 | 3 |
| *4* | 5 | 6 | 7 | 8 | 9 | 10 |
| *11* | 12 | 13 | 14 | 15 | 16 | 17 |
| *18* | *19* | 20 | 21 | 22 | 23 | 24 |
| *25* | 26 | 27 | 28 | 29 | 30 | .. |
| .. | .. | .. | .. | .. | .. | .. |

### MAY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | .. | .. | .. | 1 |
| *2* | 3 | 4 | 5 | 6 | 7 | 8 |
| *9* | 10 | 11 | 12 | 13 | 14 | 15 |
| *16* | 17 | 18 | 19 | 20 | 21 | 22 |
| *23* | 24 | 25 | 26 | 27 | 28 | 29 |
| *30* | *31* | .. | .. | .. | .. | .. |

### JUNE

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | 1 | 2 | 3 | 4 | 5 |
| *6* | 7 | 8 | 9 | 10 | 11 | 12 |
| *13* | 14 | 15 | 16 | *17* | 18 | 19 |
| *20* | 21 | 22 | 23 | 24 | 25 | 26 |
| *27* | *28* | *29* | *30* | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |

### JULY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | *1* | *2* | *3* |
| *4* | *5* | *6* | *7* | *8* | *9* | *10* |
| *11* | *12* | *13* | *14* | *15* | *16* | *17* |
| *18* | *19* | *20* | *21* | *22* | *23* | *24* |
| *25* | *26* | *27* | *28* | *29* | *30* | *31* |
| .. | .. | .. | .. | .. | .. | .. |

### AUGUST

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| *1* | *2* | *3* | *4* | *5* | *6* | *7* |
| *8* | *9* | *10* | *11* | *12* | *13* | *14* |
| *15* | *16* | *17* | *18* | *19* | *20* | *21* |
| *22* | *23* | *24* | *25* | *26* | *27* | *28* |
| *29* | *30* | *31* | .. | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |

### SEPTEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | *1* | *2* | *3* | *4* |
| *5* | *6* | *7* | *8* | *9* | *10* | *11* |
| *12* | 13 | 14 | 15 | 16 | 17 | 18 |
| *19* | 20 | 21 | 22 | 23 | 24 | 25 |
| *26* | 27 | 28 | 29 | 30 | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |

### OCTOBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | .. | .. | 1 | 2 |
| *3* | 4 | 5 | 6 | 7 | 8 | 9 |
| *10* | 11 | *12* | 13 | 14 | 15 | 16 |
| *17* | 18 | 19 | 20 | 21 | 22 | 23 |
| *24* | 25 | 26 | 27 | 28 | 29 | 30 |
| *31* | .. | .. | .. | .. | .. | .. |

### NOVEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | 1 | 2 | 3 | 4 | 5 | 6 |
| *7* | 8 | 9 | 10 | 11 | 12 | 13 |
| *14* | 15 | 16 | 17 | 18 | 19 | 20 |
| *21* | 22 | 23 | 24 | *25* | 26 | 27 |
| *28* | 29 | 30 | .. | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |

### DECEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| .. | .. | .. | 1 | 2 | 3 | 4 |
| *5* | 6 | 7 | 8 | 9 | 10 | 11 |
| *12* | 13 | 14 | 15 | 16 | 17 | 18 |
| *19* | *20* | *21* | *22* | *23* | *24* | *25* |
| *26* | *27* | *28* | *29* | 30 | 31 | .. |
| .. | .. | .. | .. | .. | .. | .. |

School Periods for Division A indicated by type thus: 1 2 3.
School Periods for Division B indicated by type thus: 1 2 3.
Periods when School is not in session indicated by type thus: *1 2 3.*

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# Calendar 1919

January 1, Wednesday
New Year's Day (School exercises omitted)

January 13, Monday
Second Term begins for Division A

January 27, Monday
Second Term begins for Division B

February 22, Saturday
Washington's Birthday (School exercises omitted)

April 19, Saturday
Patriots' Day (School exercises omitted)

May 26 to June 7 inclusive
Final examinations

May 30, Friday
Decoration Day (School exercises omitted)

June 12, Thursday
First Entrance Examinations of Co-operative School of Engineering

June 9-September 6
Summer Vacation

June 11
Annual Commencement

July
Engineering Practice for Division A commences

September
Engineering Practice for Division B commences

September 4, Thursday
Second Entrance Examinations of Co-operative School of Engineering

September 8, Monday
First term of school year for Division A commences

September 22, Monday
First term of school year for Division B commences

November 27, Thursday
Thanksgiving Day (School exercises omitted)

December 15-27, inclusive
Christmas Recess (School exercises omitted)

# Calendar 1920

January 1, Thursday
New Year's Day (School exercises omitted)

February 9, Monday
Second Term begins for Division A

February 23, Monday
Second Term begins for Division B

April 19, Monday
Patriots' Day (School exercises omitted)

May 31, Monday
Decoration Day Observance (School exercises omitted)

June 17, Thursday
Bunker Hill Day (School exercises omitted)

June 24, Thursday
First Entrance Examination of Co-operative School of Engineering

June 26-September 13
Summer Vacation

June 16
Annual Commencement

September 9, Thursday
Second Entrance Examination of the Co-operative School of Engineering

September 13, Monday
First Term of School Year for Division A commences

September 27, Monday
First Term of School Year for Division B commences

October 12, Tuesday
Columbus Day (School exercises omitted)

November 25, Thursday
Thanksgiving Day (School exercises omitted)

December 18-January 3, 1921
Christmas Recess (School exercises omitted)

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# Northeastern College

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---

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*Professor of Descriptive Geometry*

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*Professor of English*

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*Professor of Electrical Engineering*

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# Northeastern College

## FACULTY OF THE SCHOOL

### (Continued)

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*Instructor in Military Tactics*

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*Instructor in Physical Training*

# Northeastern College

## FACULTY OF THE SCHOOL
## (Continued)

| | |
|---|---|
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| Alfred Jackson Thompson<br>*Instructor in Accounting* | 93 Cross St., Malden |
| Reginald George Trotter, A.M.<br>*Instructor in War Issues* | Claverly Hall, Cambridge |
| Walter Gordon Whitman, S.B.<br>*Instructor in Chemical Engineering* | School St., Sharon |
| Abraham Albert Becker<br>*Assistant in Chemistry* | 298 Western Ave., Cambridge |
| Arthur Raymond Hawes<br>*Assistant in Chemistry* | Sudbury |
| Elmer Hanley Richardson<br>*Assistant in Drawing* | 85 Green St., Reading |
| Shaw Dearborn Sargent<br>*Assistant in Electrical Engineering* | 78 Westland Ave., Boston |
| Arthur Earle Smithies<br>*Assistant in English* | 526 Columbus Ave., Boston |

# Northeastern College

## SPECIAL LECTURERS

MATTHEW C. BRUSH, S.B.
President, Boston Elevated Railway Company
"The Human Equation in Business"

JAMES E. COLE
Commissioner of Wires, City of Boston
"Wire Trouble and Accidents"

CHARLES R. GOW, S.B.
Charles R. Gow Co., Engineers and Contractors
"Foundations of Buildings and Structures"

GEORGE B. HAVEN, S.B.
Professor of Machine Design, Massachusetts Institute of Technology
"Aircraft Fabrics"

J. HENRY NEAL
Vice-President and General Auditor, Boston Elevated Railway Company
"Engineering in its Relation to Finance"

THOMAS E. PENARD, S.B.
Engineer, Electrical Division, Edison Electric Illuminating Co. of Boston
"High Potential Phenomena"

WILLIAM THOMPSON SEDGWICK, PH.D., SC.D.
Professor of Biology and Public Health, Massachusetts Institute of Technology
"Public Health"

FRANK H. WENTWORTH
Secretary-Treasurer, National Fire Protection Association
"The Significance of the Fire Waste"

WILLIAM ELGIN WICKENDEN, S.B.
Associate Professor of Electrical Engineering, Massachusetts Institute of Technology
"Engineering as a Profession"

JOHN F. WING, A.B., PH.D.
Vice-President, New England Manufacturing Company
"Military Explosives"

## GENERAL INFORMATION

### Historical

In September, 1909, the Department of Education of the Boston Young Men's Christian Association began to offer Co-operative Engineering Courses in connection with the Evening Polytechnic School. At that time, the Co-operative Course students were employed by engineering firms on the one week period plan, one working one week while his alternate was going to school, and at the close of the week exchanging places so that the student who had been to school went to work. Conditions were such that the students attended both day and evening classes. Two years later, it was decided to establish an engineering school, to do work of college grade, based entirely on the part-time, or co-operative plan. Thus, in 1911, was started what is now the Co-operative School of Engineering of Northeastern College.

In the ten years that have elapsed since the inception of the idea, the School, which was started with no special educational requirements for entering students, and which had but little equipment and a registration of only eight pupils, has grown to be a recognized factor in the community, with rigid requirements of scholarship and character for entering students, thousands of dollars' worth of equipment, a highly trained and able faculty, and an enrollment of over three hundred and seventy-five students. It is enabling the young man of moderate financial ability to get a high-grade engineering training and at the same time not only defray his own expenses, but also become familiar with the actual practice of his profession.

### Object of the School

Technical school instruction, depending on class-room work and laboratories, must always lack some of the vital characteristics of an actual manufacturing plant. One is carried on for educational purposes, while the other is operated for dividends. It is this latter fact that gives the Co-operative School idea one great advantage over the usual educational plan. In-

stead of training the student for several years for a line of work to which he may later find himself to be entirely unfitted, the Co-operative School at once puts the boy to work in a commercial plant. There he learns life in its vital issues, as well as the problem of getting along with men; thus early finding out whether he has made a wise, or unwise, choice of his life work. This training shows him the use and value of his school work, and finally gives him an unusual opportunity to acquire from actual experience that rare thing, *executive ability,* without which his life probably would be spent on the lower levels of industry.

The fundamental aim of this School is to give young men sound training in both the theoretical and practical principles upon which professional practice is based. Thus they are enabled to advance farther and more rapidly in their chosen work than they could expect to do without further education than that of a high-school course. The training is not in any sense that of a trade school, nor is it exactly that of our best scientific schools, but it stands between the two. The work done is that of a regular engineering school of high standards; only the essential subjects are taken, and these only so far as they will have a direct bearing on the life work of the student. In other words, it is a limited technical training of high grade. The fact that most of our instructors are graduates of, or instructors in, the Massachusetts Institute of Technology, will show the character of work being done.

At present there are four branches of engineering work being given. The end sought is to give to students who have already had a high-school preparation, or its equivalent, a good training in the fundamental sciences of Mathematics, Chemistry and Physics, and in the important applications of the principles of these sciences to the several branches of engineering. More stress is laid on the development of the ability to apply the acquired knowledge to new engineering problems, than to the memorizing of a multitude of details and very abstract theory, which while valuable cannot be gone into deeply in a course of this type.

The courses differ from those of many schools, in that a student is not permitted a wide range of subjects from which

to choose. It has been found that better results are obtained by prescribing the principal studies which the student is to pursue.

## Plan of Operation of the School

To illustrate the plan of operation of the School, take the case of two men, "A" and "B," who desire to take our Mechanical Engineering Course. "A" is assigned to one of the plants of a firm that is co-operating with us. Here he is put to work, and spends two weeks working for the firm. Then "B," his alternate, who has spent the first two weeks in the School, takes "A's" place with the firm, and "A" puts in the next two weeks at school. Thus the work goes on, the two men exchanging places at the beginning of each two-week period. The studies pursued in the course have a direct practical bearing on the outside work, with the exception of a few courses. The courses given have been decided upon after conference between the co-operating employers and the school authorities, and are the result of the best ideas of both. The subjects are taught in a practical, not in an abstract or a theoretical way. Thus, in mathematics, instead of algebra, analytic geometry, and calculus taught as so many separate subjects, we have them correlated and taught as instruments for the solution of practical problems arising in engineering work. The aim throughout the course is to give it practical bearing, and yet have it complete and thorough in all the needed essentials.

## ENGINEERING EQUIPMENT

The school is now housed in the new building of the Association, and has very exceptionally equipped quarters for carrying on the work of the Engineering Courses.

### Mechanical Laboratories

Through the courtesy of the Massachusetts Institute of Technology officials, and also those of the Franklin Union, and Wentworth Institute, we are able to avail ourselves of the unexcelled Engineering Laboratories of those Institutions for instruction purposes in the laboratory courses of the Co-operative School.

In addition to the foregoing facilities, we have several engines of our own for use for instruction, as well as the most modern equipment for gas and fuel analysis.

Our own steam engineering plant is completely equipped with meters, scales, indicators, and all the necessary accessory equipment for making complete boiler tests, and determining the efficiencies of the various appliances used in generating power, heat, and light for our new building. This places at the disposal of our classes a perfectly equipped, up-to-date, engineering department, and gives them the means of carrying on boiler tests, determining the efficiencies of various fuels and oils, taking indicator diagrams, determining the efficiency of modern reciprocating engines and turbines when direct connected to generators, as well as renders them familiar with all the various auxiliary appliances of such a plant, as condensers, pumps, air compressors, etc. The students also have the use of the equipment of our Automobile School, thus having opportunity to study the most advanced ideas in gasoline engine practice.

### Mechanic Arts Laboratories

There are at present two laboratories, one for metal work and the other for woodworking and pattern work, which are available for the use of our students.

The metal working laboratory is well equipped, and affords the student an opportunity for work with various machines, as lathes, shapers, drill presses and milling machines. There

are also a gas forge and a brazing furnace, together with all the required equipment for bench work instruction.

The woodworking laboratory has a power band saw, lathes, circular saw, buzz planer, and all the necessary equipment for woodworking and pattern work.

In addition to the foregoing, a small but completely equipped shop for the construction and repair of apparatus and for the use of students in connection with their thesis work has been installed. This shop is equipped with a metal and woodworking lathe, grinder, and all the necessary wood and metal-working tools. There is also a very complete set of cabinet-worker's tools for use in woodworking.

## Field Instruments (Civil Engineering Department)

For work in the field the Civil Engineering Department possesses various surveying instruments, representing the principal makes and types of instruments in general use. The equipment includes transits, levels, compasses, plane table outfits, Locke hand levels, flag poles, leveling rods, stadia rods, engineers' and surveyors' chains, steel and cloth tapes, and other accessories. For higher surveying there is an aneroid barometer for barometric leveling, and a sextant reading to ten seconds for hydrographic surveying. The transits are equipped with neutral glasses and reflectors for astronomical observations.

There have recently been added to the equipment a Keuffel & Esser 6¾″ transit, a Buff & Buff 4¾″ Mountain Transit, a Keuffel & Esser 18″ Wye level, two surveyors' compasses, and a Gurley Electric Current meter for hydraulic measurements, as well as all the miscellaneous apparatus necessary to equip the extra parties that the new instruments would accommodate.

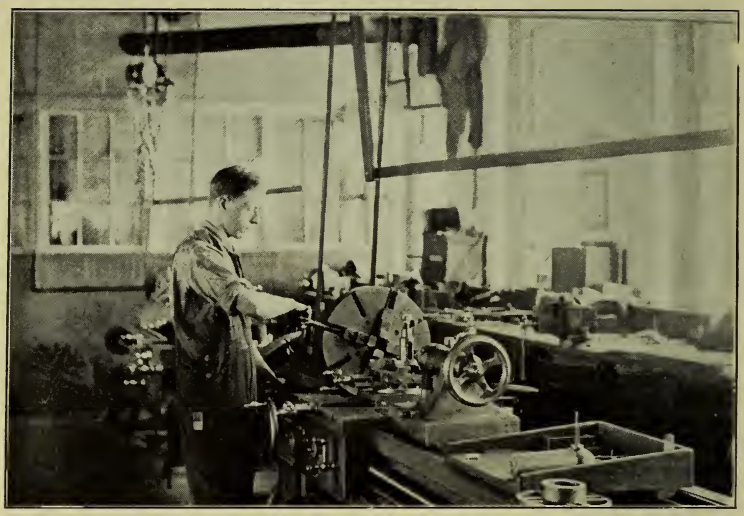
The extent of the equipment and scope of the field work itself are designed to train the student's judgment as to the relative merits of the various types of field instruments.

## Design and Drafting Rooms

The School possesses large, light, and well-equipped drawing rooms for the carrying on of the designing and drafting which form so important a part of civil engineering work.

THE LOBBY

# Mechanical Engineering Students



Machine Shop Work
Dennison Manufacturing Company—Framingham

Class in Drafting
Drafting Rooms

These rooms are supplied with lockers containing the drawing supplies, and files containing blue prints and photographs of structures that represent the best practice. Many of the prints and photographs are of structures erected in and about Boston.

## Electrical Measurements Laboratory

This is equipped with apparatus fundamentally planned for teaching the principles of measurement, rather than for the precise determination of quantitative results. Nevertheless it is necessary for the proper performance of work in the other laboratory courses that a certain amount of careful quantitative work should be done, and the equipment is being steadily increased and developed with both ends held in view.

Apparatus is available for instruction in the following: Resistance by Ohm's law, substitution and direct reflection, voltmeter methods for high resistance, insulation resistance, specific resistance, slide wire bridge, Wheatstone bridge, current by electrolysis, electrostatic capacity, inductance, Poggendorf's method of E M F comparison, etc., under the first head and for work under the second head there is considerable apparatus among which may be mentioned, a conductivity bridge, a Laboratory standard Wheatstone bridge, a Kelvin low resistance bridge, a Leeds Northrup potentiometer with two standard Weston cells, volt box and steady source of high voltage for voltmeter calibration, numerous standard shunts and a 600 ampere hour storage battery for ammeter calibration, a commutator and leads for use with the Cary-Foster method and a chemical balance.

The Instrument Room is supplied with four G.E. 300-150-15 DC voltmeters, and four double range Weston's, four single range ammeters, six millivoltmeters with twelve interchangeable shunts of various ranges up to 100 amperes, all of high grade, together with numerous similar instruments of cheaper quality for lower-class work. For alternating current testing there are:

Three General Electric type P-3 single phase wattmeters with double voltage and current ranges arranged for Y connection; two Polyphase wattmeters of similar type and ranges, one of similar type specially constructed for measurement of

core loss, three integrating wattmeters and one rotating standard.

Three 300-volt, three 150-volt and three 50-volt voltmeters.

Three 50-ampere, three 25-ampere, three 15-ampere, three 10-ampere, three 5-ampere and three 1-ampere ammeters, these all being in groups of three for polyphase work; and a Laboratory standard AC voltmeter with extension coils.

There is also a considerable amount of auxiliary apparatus such as frequency indicators, synchroscopes, and power factor meters.

## Electrical Engineering Laboratory

This is equipped with numerous machines of different types, the size and voltage ratings being selected to reduce as much as possible the risk from large voltage and power apparatus, while at the same time availing the student of apparatus of commercial sizes such that the various quantities it is desired to measure will be of reasonable dimensions.

Small machines are used mostly for this reason, and also because the students in their Engineering Practice come in contact with the large sized and varied machinery of modern powerhouses and electrical plants continually.

Among the machines of this department are a pair of specially made matched machines, constructed to operate as single, two, or three phase generators, or motors, as well as synchronous converters, or double current generators. On the direct-current side, these machines will operate as shunt, series, or compound generators, either two or three wire, or as shunt, series, or compound motors. There is a 15 H. P. Westinghouse compound motor, a 3 K. W. compound generator, a 1 K. W. series generator, a 5 H. P. General Electric interpole motor, a 5 H. P. General Electric series motor, a 4 H. P. shunt motor, two 3 H. P. shunt motors, and a 2 H. P. shunt motor; also a 7½ kv-a. special General Electric alternator driven by a 10 H. P. General Electric interpole motor, and a 5 kv-a. Holtzer Cabot alternator driven by a 10 H. P. Fort Wayne shunt motor. This last machine has two special rotors, permitting its use as a squirrel-cage or phase-wound, induction motor. In addition, there is a 5 K. W. Holtzer-Cabot three-phase synchronous convertor, a 5 H. P. General

Electric induction motor, which can be operated two or three phase, a 15 kv-a. three phase alternator, giving practically a pure sine wave, and three General Electric transformers, each of 3 kv-a. capacity. During the past year there has been added three special 1 K. W. single-phase transformers, with leads arranged to give various types of transformer primary and secondary connections, also a set of reactances for making up three phase inductive loads with extremely low power factor and a similar set of condensers.

There is also available for advanced instruction, in co-operation with the Mechanical Engineering Department, the four three-wire generators in the main generating plant. Three of these generators are driven by Ridgeway reciprocating engines and one by a Westinghouse-Parson turbine.

## Physics Laboratories

The Physics department has been very completely equipped with all necessary apparatus for the experimental work that is required of the students, as well as that required for lecture demonstration. There is a large laboratory together with a lecture room devoted entirely to Physics. Among other things have been added verniers, levels, spherometers, calorimeters, thermometers, pyrometers, a spectroscope, a microscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, a full set of Weather Bureau apparatus, including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers, etc. These, in addition to the equipment already owned, give a wide range to the experimental work that can be done.

## Chemical Laboratories

The School has three laboratories completely equipped in all respects for carrying on all lines of chemical work, from that of a high school to that of most advanced college grade. They have accommodations for over one hundred and fifty students, and are suitably furnished with all the necessary appliances for chemical work. Some of these are: hoods, drying closets, a still, steam and hot water baths, electrolytic

circuits, vacuum and pressure apparatus, balances, combustion furnaces, and complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this department where are kept specimens for purposes of illustration.

## Libraries

The School shares the privileges of the steadily growing Y.M.C.A. Libraries in the Main Building. It also supports a professional library distributed among the various departments. In addition to this, it subscribes to current periodicals on engineering and scientific subjects for the exclusive use of students. All members of the School are entitled to take books from the Boston Public Library, and this offers a very unusual opportunity to our non-resident students.

## Department of Physical Training

Our new gymnasium with all the latest modern equipment gives ample accommodation for all students. There is a running track on the grounds adjoining, together with tennis and hand ball courts; also a large natatorium where swimming is taught by competent instructors. In connection with this department there are also six excellent bowling alleys, which may be used by the students upon the payment of a nominal fee.

# ENGINEERING PRACTICE

## Correlation of Practical and Theoretical Work

The engineering practice of the student is progressive and is as carefully planned as the work done at the School. The employers who co-operate with us generally agree, where practicable, to employ the students in all the different departments of their establishments during their periods of engineering practice. This training is just as complete as the school work, and is just as thorough. Where possible, the course of the learner is from the handling of the raw material to the shipment of the finished product. This practical training includes the use of the machines, as well as the executive duties of the plant, so that at the end of his course the graduate may not only know how to do things, but also why they are done in certain ways; and we hope he may be of value in improving methods of work.

## Number of Students

The number of positions at our disposal in any one branch of engineering is necessarily limited, and naturally the number of students who can work part time in that line is also limited. In consequence of this, those students who apply first will get first consideration in the matter of positions. Those who wish to enter are urged to present their applications as early as possible.

The applicants who apply for admission to the School too late to be assigned to practical work, may attend the School every period, or every alternate period, as they may wish, and will be assigned to practical work as soon as an opening occurs.

## Attitude of Co-operating Firms

The favorable attitude of the co-operating concerns toward our plan is shown by their retention of the same students from year to year, even after graduation, and also in the fact that whenever any vacancies occur which can be filled by our men, they make immediate application for additional students to fill them.

## Co-operating Firms

American Dyewood Co.
American Glue Co., Peabody
American Steam Gauge and Valve Co.
Anderson Brothers, Chemists.
Appleton, Thomas A., Civil Engineer, Salem.
Aspinwall and Lincoln, Civil Engineers.
Barnes, Rowland H., Civil Engineer.
Bay State Street Railway Company.
Beal, H. F., City Engineer, Waltham.
B. F. Sturtevant Co., Hyde Park.
Bio-Chemical Laboratory.
Boston Elevated Railway Co.
Boston & Albany Railroad Co.
Boston & Maine Railroad Co.
Boston Consolidated Gas Co.
Bryant, H. F., Civil Engineer.
Carr, J. Lewis, Civil Engineer.
Condit Electrical Manufacturing Co.
Crofoot Gear Works.
Dennison Manufacturing Co., Framingham.
Edison Electric Illuminating Co.
Evas, R., Essex County Engineer, Salem.
Evatt Construction Co.
Foxboro Instrument Co.
Fred B. Saunders Co., Engineers, Framingham.
General Electric Co., Lynn.
George E. Fuller Construction Co.
Glenlyon Dye Works, Saylesville, R. I.
H. G. Butt Manufacturing Co.
Hunt-Spiller Corp., Iron Founders.
J. H. Long Machine Co.
Lever Brothers Co., Soap Manufacturers.
L. E. Knott Apparatus Co.
Lustron Chemical Co.
Merrimac Chemical Co.
Miles, George W., Chemist.
New England Structural Co.
New York, New Haven and Hartford Railroad Co.
Norton Grinding Co., Worcester.
Potter, Herbert S., Electrical Contractor.
Prescott, Samuel C., Sanitary Chemist.
Providence Dyeing, Bleaching and Calendering Co.
Punchard, William H., Landscape Architect.
Ruggles and Klingeman Co., Salem.
Samuel Cabot, Inc., Manufacturing Chemists.
Sanborn Company, Instrument Makers.
Sherry, Frank E., Civil Engineer.
Simplex Electric Heating Co.
Simplex Wire and Cable Co.
Spray Engineering Company.
Tileston & Hollingsworth Paper Co.
Trimont Manufacturing Company.
United Shoe Machinery Co., Beverly.

VENNARD, WILLIAM L., City Engineer, Lynn.
WARREN BROTHERS CO., Paving Materials.
WERBY CHEMICAL LABORATORIES.
WHIDDEN-BEEKMAN CO., Construction Engineers.
WHITMAN & HOWARD, Civil Engineers.

Thus far we have secured new positions for our students as the growth of the School has demanded. Nevertheless, to be at all sure of work in his chosen branch of engineering, an applicant should file his application early.

Sometimes, students may secure their own positions with firms, in which case an alternate can usually be furnished by the School, if desired. Such individual arrangements are entirely acceptable to the School, and may be made by any applicant, subject to the approval of the Dean.

## Schedules of Practical Work

Below are typical schedules of engineering practice that have been prepared for our students by some of the companies which are giving them employment. These schedules are being revised to conform to the slightly revised method of operating the School:

**Boston Elevated Railway Co.**

| | | |
|---|---|---|
| FIRST YEAR. | Pit Work in Carhouse, | 6 months |
| | Armature Room, | 6 months |
| SECOND YEAR. | Machine Shop Work | 12 months |
| THIRD YEAR. | Mechanical Drafting Room, | 6 months |
| | Pattern Shop and Foundry, | 6 months |
| FOURTH YEAR. | Line Department, | 6 months |
| | Electrical Engineer's Department, | 6 months |

**Boston & Maine Railroad Co.**

| | | |
|---|---|---|
| FIRST YEAR. | Air Brake Shops, | 6 months |
| | Erecting Work, | 6 months |
| SECOND YEAR. | Erecting Work, | 6 months |
| | Machine Shop, | 6 months |
| THIRD YEAR. | Machine Shop, | 6 months |
| | Mechanical Drafting Room, | 6 months |
| FOURTH YEAR. | Engine House Repairs, | 6 months |
| | Drafting Room and Testing Work, | 6 months |

**Boston Consolidated Gas Co.**

| | | |
|---|---|---|
| FIRST YEAR. | Data Takers, | 9 months |
| | Office, | 3 months |
| SECOND YEAR. | Pipe Fitter's Helpers, | 3 months |
| | Pump Man's Helpers, | 3 months |
| | Blowers and Exhausters, | 3 months |
| | Laboratory, | 3 months |

| | | |
|---|---|---|
| THIRD YEAR. | Boiler Room, | 3 months |
| | Generator House, | 3 months |
| | Steam Fitters, | 3 months |
| | Machine Shop, | 3 months |
| FOURTH YEAR. | Assistant Engineers, | 3 months |
| | Laboratory, | 6 months |
| | Distribution Department, | 3 months |

**Simplex Wire & Cable Co.**

| | | |
|---|---|---|
| FIRST YEAR. | Insulating Department, | 6 months |
| | Braiding Department, | 6 months |
| SECOND YEAR. | Cable Shop, | 6 months |
| | Twisting Department, | 6 months |
| THIRD YEAR. | Machine Shop Construction Gang, | 6 months |
| | Electrical Construction Gang, | 6 months |
| FOURTH YEAR. | Testing Room, | 12 months |

**Simplex Electric Heating Co.**

| | | |
|---|---|---|
| FIRST YEAR. | Machine Department, | 12 months |
| SECOND YEAR. | Grinding Department, | 1 month |
| | Stock Department, | 4 months |
| | Winding Department, | ½ month |
| | Enameling Department, | ½ month |
| | Assembling Department | 6 months |
| THIRD YEAR. | Testing Department, First Division, | 6 months |
| | Testing Department, Second Division, | 6 months |
| FOURTH YEAR. | Shipping Department, approximately, | 2 months |
| | Drafting Department, approximately, | 4 months |
| | General Shop experience, | 6 months |

**Condit Electrical Manufacturing Co.**

| | | |
|---|---|---|
| FIRST YEAR. | Shipping or Receiving, | 4 months |
| | Cost and Estimating, | 4 months |
| | Stock Room, | 4 months |
| SECOND YEAR. | Machine Department, | 4 months |
| | Direct-Current Assembly, | 4 months |
| | Alternating-Current Assembly, | 4 months |
| THIRD YEAR. | Inspecting and Testing Department, | 6 months |
| | Experimental Department, | 3 months |
| | Drafting Department, | 3 months |
| FOURTH YEAR. | Switchboard Department, | 6 months |
| | Engineering Department, | 6 months |

**The Dennison Manufacturing Co.**

| | | |
|---|---|---|
| FIRST YEAR. | Carpenter's Helper, | 4 months |
| | Pattern Maker's Helper, | 3 months |
| | Elevator, Fire Door, Shafting, etc., | 2 months |
| | Helpers in Millwright's and Electrician's Gangs, | 3 months |
| SECOND YEAR. | Machine Shop Stock Room, | 1 month |
| | Machine Shop, | 9 months |
| | Grinding Room, | 2 months |

# Students Engaged in Engineering Practice


Making a High Tension Test
Edison Electric Illuminating Company

Drafting
Designing Engineer's Office—B. & A. Railroad

# Students Engaged in Engineering Practice

Drafting and Blue-Printing
American Steam Gauge and Valve Company

Grinding Castings
Machine Shop—Boston Elevated Railway Co.

| | | |
|---|---|---|
| THIRD YEAR. | Power Plant Work the time to be put in at the option of the Company), | 3 months |
| | Accident Prevention Work, | 4 months |
| | Experimental Work (machine work), | 3 months |
| | Filing Plans, Blue Printing, Tracing, etc., | 2 months |
| FOURTH YEAR. | Tracing and General Work, | 2 months |
| | Detailing and General Drafting, | 10 months |

**Boston & Albany Railroad Co.**

| | | |
|---|---|---|
| FIRST YEAR. | Work in Field Party, | 12 months |
| SECOND YEAR. | Work in Drafting Room, | 12 months |
| THIRD YEAR. | Masonry Inspection and General Railroad Work, | 6 months |
| | Railroad Accounting, | 6 months |
| FOURTH YEAR. | Railroad Accounting, | 6 months |
| | Timekeeping and Unit Costs, | 6 months |

The above programmes give a general idea of what some of the students do in their practical work, and the courses of study pursued at the School show what they do along academic lines. It will be seen that there is the greatest possible degree of correlation between theory and practice in the work they take up. The men under whose supervision the students have been in their outside work are practically unanimous in approval of our plan, and speak highly of the enthusiasm, earnestness and intelligence the students have shown in the performance of their duties.

## Earnings

For the practical work the student does he is paid a certain amount per hour or per week at the start, and a definite increase per hour or week after completing fixed periods of service. The sum earned is more than enough to pay the tuition and the necessary expenses of schooling, but does not cover the cost of living.

In many cases the boys are paid at a higher rate than is called for by their schedule of pay, but this is due to the courtesy of the company that gives them employment, and is not in any way to be expected as a regular thing. The co-operating firms may make any salary schedule they desire, so long as it does not fall below that originally agreed upon.

Since there are about thirty weeks of work per year, the earnings will be from two hundred and forty dollars upwards.

Frequently a student is able to earn much more than the regular rate, owing to his getting extra pay for overtime work.

A census of our students who were working in January, 1919, gave the following data in regard to earnings:

| | |
|---|---|
| Minimum weekly wage, | $8.00 |
| Maximum weekly wage, | 20.00 |
| *Minimum earnings for year 1918, | 240.00 |
| *Maximum earnings for year 1918, | 600.00 |

*Based on a total working period of thirty weeks.

## Expenses

Since the earnings of the students average from $240 to $600 a year from their practical work, while expense for tuition, books, drafting supplies, etc., and membership in the Y.M.C.A. is not over $130 to $140, there is a considerable balance for incidentals.

While the School supplies all books, drawing instruments, slide rules, etc., the supply department has found it impracticable to furnish the students with notebooks, paper, drawing ink, pencils, etc. In consequence, the student will have a slight expense, of probably less than five dollars per year, for such materials.

## Relation of School to High Schools

This School is peculiarly adapted to the high school graduate who although financially unable to continue his studies further still has the ambition and ability to get ahead if given the opportunity. Thus students who can still live at home, after being graduated from high school, are able to fit themselves for something better than the positions filled by untrained men.

This year the School has a student body made up of graduates of the following schools:

Abington High School
Amherst High School
Ashland High School
Assumption High School
Athol High School
Ayer High School
Barnstable High School
Belfast (Me.) High School
Belmont High School
Berkeley Preparatory School
Beverly High School
Bingham (Me.) High School
Boothbay Harbor (Me.) High School
Boston College High School
Boston English High School
Boston Central Evening High School
Boston High School of Commerce
Brewster Free Academy (N. H.)
Bridgewater High School
Brighton High School

Brockton High School
Brookline High School
Cambridge High and Latin High School
Cambridge Rindge Technical High School
Chelsea High School
Chester High School
Chester (Conn.) High School
Chicopee High School
Clinton High School
Concord High School
Concord (N. H.) High School
Dalton High School
Danvers High School
Dedham High School
Dennis High School
Dexter High School
Dorchester High School
Douglas High School
East Bridgewater High School
Eastport (Me.) High School
Elizabeth Lowell High School
Everett High School
Fairfield (Me.) High School
Fairhaven High School
Fall River High School
Falmouth High School
Fitchburg High School
Foxboro High School
Framingham High School
Franklin High School
Fryeburg (Me.) High School
Gardiner (Me.) High School
Gloucester High School
Goddard Seminary (N. Y.)
Gorham (Me.) High School
Groveland High School
Hardwick High School
Harvard High School
Harwich High School
Hingham High School
Holbrook High Schol
Holliston High School
Huntington Preparatory School
Killingly (Conn.) High School
Kingston High School
Malden High School
Marlboro High School
Marblehead High School
Marshfield High School
Mechanic Arts High School
Medford High School
Medway High School
Middleboro High School
Milford High School
Monepelier (Vt.) High School
Nashua (N. H.) High School
Natick High School
New Boston (N. H.) High School
New Britain (Conn.) High School
Newburyport High School
Newton High School
Newton Technical High School
Newton Vocational School
Nicolet Academy (Canada)
Northbridge High School
Norway (Me.) High School
Norwood High School
Nowell High School
Phillips Andover Academy
Plainville High School
Plymouth High School
Provincetown High School
Quincy High School
Reading High School
Reed's Ferry (N.H.) High School
Revere High School
Rochester (N. H.) High School
Rochester (N. Y.) High School
Rockland High School
Rockland (Me.) High School
Roxbury Commercial High School
Rutland (Vt.) High School
Sacred Heart (R. I.) High School
Salem High School
Sanderson Academy
Saugus High School
Scituate High School
Sharon High School
Somerville High School
South Boston High School
South Portland (Me.) High School
St. John's Military Academy
Stone Preparatory School
Stoughton High School
Sudbury High School
Turina University (Italy)
Wakefield High School
Waltham High School
Watertown High School
Wellesley High School
Westbrook (Me.) High School
Weymouth High School
Wilmington High School
Windham High School
Winthrop High School
Woburn High School
Woodstock (Conn.) Academy
Woodsville (N. H.) High School
Worcester Academy
Worcester Boys' Trade School
Worcester Classical High School

## Four-Year Courses

Regular four-year courses, leading to a diploma, are offered in the following branches of engineering:

I. Civil Engineering.
II. Mechanical Engineering.
III. Electrical Engineering.
IV. Chemical Engineering.

Descriptions of these courses and schedules showing the subjects of instruction included will be found on succeeding pages.

## Three-Year Course

It has been found possible for students to attend school every week and to complete the course in three years. To do this, however, the student must have a good high-school education and must omit the practical work in connection with the course except during his third year at the School.

Special permission to take a three-year course must be granted by the Faculty before a student will be permitted to enroll for such a course.

Students completing the course in three years will be required to pay the full tuition of the four-year course; namely, five hundred (500) dollars, before being awarded a diploma.

## REQUIREMENTS FOR ADMISSION

### General Statement

In general, the preparation necessary to enable an applicant to pursue successfully one of the regular courses in the Co-operative School corresponds to the four-year course of study offered by high schools of the better grade. The requirements of age and scholarship are regarded as the minimum in all ordinary cases, and only exceptional circumstances will justify any relaxation. Parents and guardians are advised that it is generally for the ultimate advantage of the student not to enter under the age of sixteen years. Every applicant must furnish references as to his character and ability, and must show cause why he may reasonably be expected to make a success of his course, both in the School and in Engineering Practice. He must be willing and able to work hard, both mentally and physically.

### Admission to the First Year

Applicants for admission as regular students to the Co-operative School of Engineering are required to present evidence of graduation from accredited four-year high schools, or the equivalent, and to have included in their courses of study Algebra as far as Quadratics and Plane Geometry. The completion of fifteen units of preparatory subjects satisfactory to the Committee on Admission is considered equivalent qualification. In special cases, however, students presenting thirteen units which are satisfactory to the Committee on Admission may be permitted to enter with two units conditioned, provided these conditioned units are made up, as prescribed by the Committee on Admission, in Northeastern Preparatory School (evening school) or some other good preparatory school.

Students whose high school courses have not included the required Algebra and Plane Geometry must take special entrance examinations, the dates of which are scheduled elsewhere. Certificates of entrance examinations passed for admission to colleges, or technical schools of good standing, may

be accepted in lieu of entrance examinations. It is assumed that applicants for admission have had a course in high school Physics. Those who have not taken such a course in their preparatory work will be required to take a course in laboratory experiments at the School in addition to the regular first year schedule.

In exceptional cases a student who is not a high school graduate may be allowed to enter as a special student, but only after his case has been passed on favorably by the Committee on Admission and the Dean. Every applicant is urged to remain in high school until he is graduated even though he could qualify for entrance before receiving his high school diploma.

A student obtaining a low rating on his entrance examinations, or who may not be eligible to assignment to Engineering Practice for other reasons, may by special permission be allowed to attend school either every period or every alternate period. Such students may be required to take a special intensive course in mathematics given in the first part of the first year, in addition to the regular first year work. When a student's record justifies such a procedure, he may be assigned to Engineering Practice.

## Application for Admission

Each applicant for admission to the School is required to fill out an application blank, whereon he states his previous education, as well as the names of persons to whom reference may be made in regard to his character and previous training.

The last page of this catalog is in the form of an application blank. It should be filled out in ink and forwarded with the required five dollar deposit, to Carl S. Ell, Dean, 316 Huntington Avenue, Boston, Mass.

Upon receipt of the application blank, properly filled out, together with the required deposit, the School at once looks up the applicant's references and high school records. When replies have been received to the various inquiries instituted, the applicant is at once advised as to his eligibility for admission to the School. All applicants must meet the Dean for a personal interview before being finally accepted by the School.

## First Tuition Payment and Gymnasium Fee

Should a student wish to be assigned to a position with a co-operating firm before the regular opening of School, he is required to fill out a registration card and also an application for membership in the Association. The first payment of tuition must be paid before he will be assigned to any position at Engineering Practice.

Before any student shall be allowed to attend classes, or be given supplies, he shall have made a total payment of sixty (60) dollars. This is in addition to the application fee of five (5) dollars and the gymnasium fee of two dollars and fifty cents and may be paid at any time before school opens.

Make all checks and money orders payable to the Bursar, Northeastern College.

## Birth and Educational Certificates

The passage of the recent law, by the Legislature, in regard to the hours and conditions of labor by minors, makes it necessary that all students under twenty-one years of age shall obtain Educational Certificates before they can be accepted by co-operating firms. For those students who plan to take the practical work, and who live outside of Boston, it will save time and trouble to bring a Certificate of Birth, or an Educational Certificate, with them on coming to Boston. The Educational Certificates are obtained free, upon request, from the Superintendent of Schools in the city, or town, where the student lives, if he lives in Massachusetts. For students living in other states a Certificate of Birth, or its equivalent, is all that will be necessary.

## Entrance Examinations in Boston

Examinations for admission to the first year class will be held at 316 Huntington Avenue on June 12 and on September 4, 1919.

Students are advised to attend the June examinations, if possible, in order that any deficiencies then existing may be made up in September, before entrance.

### Subjects for Examination

Applicants who have not passed Algebra to Quadratics and Plane Geometry satisfactorily in their courses of study in high school are required to pass entrance examinations in these subjects.

The detailed requirements in these subjects are as follows:

### Algebra

The four fundamental operations for rational algebraic expressions; factoring, determination of highest common factor and lowest common multiple by factoring; fractions, including complex fractions; ratio and proportion; linear equations, both numerical and literal, containing one, or more, unknown quantities; problems depending on linear equations; radicals, including the extraction of the square root of polynomials and numbers; exponents, including the fractional and negative.

### Plane Geometry

The usual theorems and constructions of good text-books, including the general properties of plane rectilinear figures; the circle and the measurement of angles; similar polygons; areas, regular polygons and the measurement of the circle. The solution of numerous original exercises, including loci problems. Applications to the mensuration of lines and plane surfaces.

### Copies of Former Entrance Examinations

By writing the School, prospective applicants may receive copies of former entrance examinations. These copies are available for distribution and may be obtained at any time.

### Order of Examinations

Thursday, June 12, 1919—
10:00 a. m. to 12:00 m., Algebra;
1:00 p. m. to 3:00 p. m., Plane Geometry.
Thursday, September 4, 1919—
10:00 a. m. to 12:00 m., Algebra;
1:00 p. m. to 3:00 p. m., Plane Geometry.
No fees are to be paid at the time of the examination.

### Probation Period

When, for any reason, it is deemed advisable, the School reserves the right to place any entering student upon a period of probation, extending from one to three months, before placing him at practical work. Whether he shall be placed at work at the end of this time or not will be determined by the character of the work that he has accomplished during this probationary period.

## SCHOOL INFORMATION IN DETAIL

### Location

The buildings are located at 316 Huntington Avenue, just beyond Massachusetts Avenue, and are within easy access to the various railroad stations and the business and residential sections.

### Residence

It has been found to be much more satisfactory for the student to live within easy access of Boston, than to live out twenty-five or thirty miles. The saving of time and effort more than offset any increased expense, and it is recommended that, where possible, arrangements be made to this end. Such local residence also enables the student to have a wider range of positions to choose from, since he can readily report for work at 7 a. m., if necessary, which is impossible for those students living at a distance.

Where students live in towns, or cities, twenty-five or thirty miles from Boston, it is often possible to arrange for them to work in or near their home towns, during the periods of practical work, by getting some local concern to furnish them with suitable employment.

For those students who will not be living at home, there are excellent accommodations, at very moderate rates, in the dormitories in our new building. These rooms may be had separately, or in groups with a common reception room, and the price varies from $2.00 per week, upwards. Since board

costs from $4.00 to $6.00 a week, a student could get room and board for from $7.00 to $8.00 a week.

The School officials have no authority in the matter of dormitory assignments. Students should write the House Secretary for rooms in the dormitories.

## School Year

The term begins September 8, 1919, and on succeeding years the school year will commence on the second Monday in September. The school exercises are suspended on legal holidays and for two weeks at Christmas. The School year for 1919-1920 closes on the twenty-sixth of June.

## Attendance

Students are expected to attend all exercises in the subjects they are studying, unless excused by the Dean. With the exception of one hour in the middle of the day, exercises are held, and students are, in general, expected to devote themselves to the work of the School between 9 a. m. and 5 p. m. on every week day, except Saturday. Saturday classes are held only between 9 a. m. and 12 noon.

## Tuition Fees

A fee of five (5) dollars as an application fee is to be paid when the application is filed. This fee is non-returnable, if the applicant is accepted. If he is rejected, one-half the deposit will be returned.

The tuition fee is $125 per year, and must be paid by entering students as follows: Sixty dollars at beginning of fall term; thirty-five dollars December 1; thirty dollars March 1.

Failure to make the required payments on time renders the student liable to be barred from his classes until the matter has been adjusted with the Bursar.

This tuition fee includes membership in the Association, as well as the use of all books, drawing instruments, etc., which are required in the school work.

### Special Tuition Fee for Three-Year Course

Students completing one of the four-year courses in three years will be required to pay the full tuition of the four-year course, namely, five hundred (500) dollars, before being awarded a diploma. The extra tuition shall be added to the regular tuition, as follows: First year, fifty dollars; second year, fifty dollars; third year, twenty-five dollars. Excess payments over the year's tuition shall be paid in installments with the regular tuition payments, as follows: First and Second years, twenty-five dollars at the beginning of the fall term, and twenty-five dollars on or before December first; Third year, twenty-five dollars at the beginning of the fall term.

### Laboratory Fee and Breakage Deposit

All students taking Chemical Laboratory work are charged a nominal fee of five dollars per year. This fee is non-returnable after a student has enrolled and been assigned his desk in the laboratory. Students taking Chemical Laboratory work are also required to make a deposit of $5 at the beginning of each year from which deductions are made for breakage and destruction of apparatus in the Laboratory and any remaining portion is returned to the student at the end of the school year. In case the charge for such breakage or destruction of apparatus is more than $5 the student is charged this additional amount.

### Payments

All payments should be made to Galen D. Light, Bursar.

All checks should be made payable to The Bursar, Northeastern College.

### Refunds

Refunds will be granted in accordance with the regular rules of Northeastern College. In computing refunds, students shall be charged at the rate of seven and one-half dollars per week for each week of school attendance, and in addition to this shall be charged an extra twenty dollars over and above

this weekly rate. Refunds shall be computed from the day on which the School receives formal notice of student's intentions to leave, at which time also all his supplies shall be returned, or paid for. No application for refunds will be considered until the student's supplies have all been returned, or paid for.

### Books and Supplies

The student is furnished with all books, drawing instruments, slide rules, and general supplies required for his work. This material is loaned to him during the school year, and must be returned in good condition on demand, or else paid for. No supplies will be furnished by the School for third and fourth year work after July 1, 1920.

Such materials as pens, pencils, note-books, triangles, scales, drawing paper, and tracing cloth, are not supplied by the School, but may be purchased by the student at a very small expense.

### Elective Subjects

Students electing any subject not included in their regular schedule will be required to take all examinations in that subject, and to attain a passing grade, before they will be eligible for the diploma of the School.

### Status of Students

The ability of students to continue their courses is determined by means of daily work and examinations, but regularity of attendance and faithfulness to daily duties are considered equally essential.

Any student failing to make a satisfactory record, either in school or practical work, may be removed from his position in practical work, or from the School.

A special student is permitted to attend the School, subject to the approval of the Faculty, and may be permitted to take such subjects as the School offers without having passed dependent subjects.

## Examinations

Examinations covering the work of the year are usually held at the close of each school year, in June. Exceptions may be made in certain courses where, in the opinion of the Head of the Department, examinations are not necessary. In such cases, with the consent of the Dean, they may be omitted. When a final examination is taken, the year's rating in the subject is usually based one-third on the examination and two-thirds on the record for the year's work.

## Rules of Standing in Scholarship

A student's grade is officially recorded by letters and percentages, as follows: A, excellent, 90 to 100 per cent; B, good, 80 to 89 per cent; C, fair, 70 to 79 per cent; D, passable, 60 to 69 per cent; F, work incomplete or otherwise unsatisfactory, 50 to 59 per cent; FF, complete failure, below 50 per cent.

A final mark of F imposes a condition which must be removed normally by examination upon the afternoons during the first week of the school year for each Division unless otherwise specified by the School. Special examinations can be arranged for only by vote of the Faculty. For all such examinations the College requires the payment of a special fee of five dollars. In case a mark of F is not removed at the date set, the entry will be changed to FF. The student must then discontinue any dependent subjects which he is taking, and can obtain a clear record only by repeating the subject in which F was given. The responsibility for the removal of the condition rests with the student, who is required to ascertain when and how the condition can be removed.

Any student who at the close of the school year has a final record of F in more than two subjects, or a final record of FF in more than one subject, automatically becomes a special student, and remains such until these conditions are removed. This involves the loss of the privilege of being a candidate for a diploma with his class and may involve the loss of assignment to Engineering Practice.

No student may qualify as a candidate for a diploma in any given year unless clear in all the required subjects of the lower years of his chosen course. He must also be in good standing in all courses for which he is enrolled.

Entrance requirements or preparatory subjects pursued in the School are considered as required school work.

Cases of special students will be settled by the appropriate standing committees of the Faculty.

## Absences

No "cuts" are allowed, and a careful record of attendance upon exercises is kept for each student. Absence from exercises regularly scheduled in any subject will seriously affect the standing of a student, and may cause the removal of the subjects from which he is absent from his schedule and the listing of these subjects as conditioned subjects. In case he presents a reasonable excuse for the absence however, he may be allowed to make up the time lost and be given credit for the work; but he must complete the work at such time and in such manner as his instructor in the subject, with the approval of the Head of his course, shall designate. Laboratory work lost can only be made up when it is possible to arrange for the necessary time during hours when these departments are open for regularly scheduled instruction. Absences from exercises immediately preceding or following a recess are especially serious and entail severe penalizing.

## Reports of Standing

Informal reports of the students' standing are issued four times during the school year to first year students, and two times during the year to upperclassmen. Formal reports, covering the year's work, are issued to all students at the close of each year. These reports are made in duplicate, one copy being furnished directly to the student's adviser, while the other is sent to his parents, or guardian.

Parents or guardians will be notified in all cases when students are advised, or required, to withdraw from the School, or placed on probation.

Owing to the short school year, it is of vital importance to the student that he get a clear record in all his work each week. When a student fails to pass in any subject, a notification may be sent to his parents, or guardian, to that effect, so that we may have the home influence exerted to bring his work up to a higher rating.

Every effort is made to keep the student up in his studies. Parents and students are always welcomed by the Dean for conference upon such matters. Special reports on a student's work will be sent to parents at any time, upon request.

## Conduct

It is assumed that students come to the School for a serious purpose, and that they will cheerfully conform to such regulations as may from time to time be made. In case of injury to any building, or to any of the furniture, apparatus, or other property of the School, the damage will be charged to the student, or students, known to be immediately concerned; but if the persons who caused the damage are unknown, the cost for repairs may be assessed equally upon all the students of the School.

Students are expected to behave with decorum, to obey the regulations of the School, and to pay due respect to its officers. Conduct inconsistent with the general good order of the School, or persistent neglect of work, if repeated after admonition, may be followed by dismissal, or, in case the offense be a less serious one, the student may be placed upon probation. The student so placed upon probation may be dismissed if guilty of any further offense.

It is desired to administer the discipline of the School so as to maintain a high standard of integrity and a scrupulous regard for truth. The attempt of any student to present, as his own, any work which he has not performed, or to pass any examination by improper means, is regarded as a most serious offense, and renders the offender liable to immediate expulsion. The aiding and abetting of a student in any dishonesty is also held to be a grave breach of discipline.

## Socials

In order to provide for the social intercourse of the students, as well as to enable the men in the different divisions to meet one another, socials and entertainments are held for their exclusive enjoyment. An out-door field meet is also held yearly, at the close of the school year, at which time various interclass competitive games are enjoyed.

## Outside Interests

A moderate participation in social and athletic activities is encouraged by the Faculty, although a standard of scholarship which is incompatible with excessive devotion to such pursuits is required of the students.

## Vacations

Each student has one week of vacation at Christmas time and five weeks during the summer. During the Christmas period of 1919 Division A will have a vacation from December 15 to 20 inclusive and Division B from December 22 to 27 inclusive.

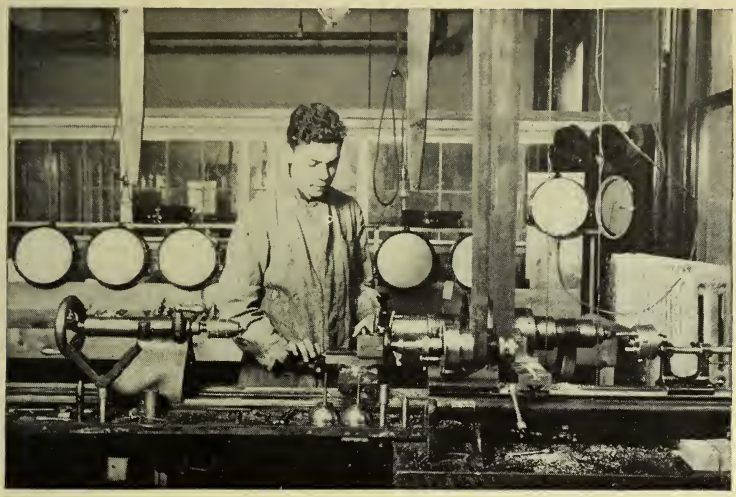
## Summer Employment

When a student, for good reason, is unable to continue his Engineering Practice during the summer while the School is not in session, it is sometimes possible to get him leave of absence for the summer so that he can return to his employer in the fall. All special arrangements for the summer work must be referred to the Dean.

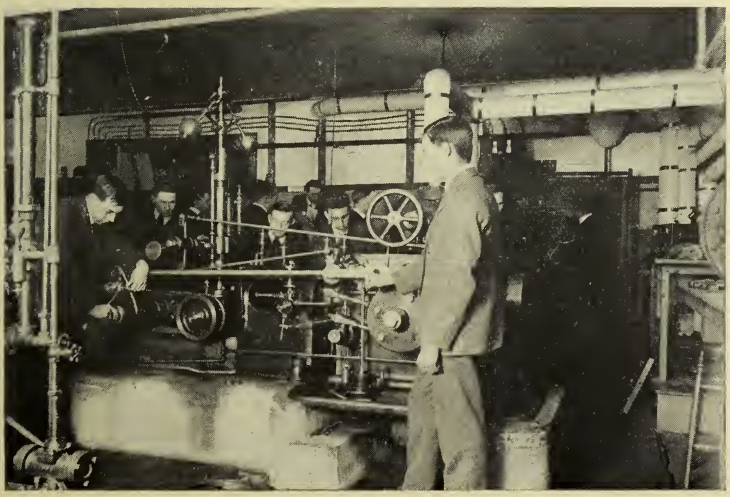
## Summer Preparatory Schools

There are day and evening summer preparatory schools, conducted by the Northeastern Preparatory School, and students having entrance conditions, or requiring further preparation for the entrance examinations, may avail themselves of this opportunity to cover the desired work.

# Mechanical Engineering Students



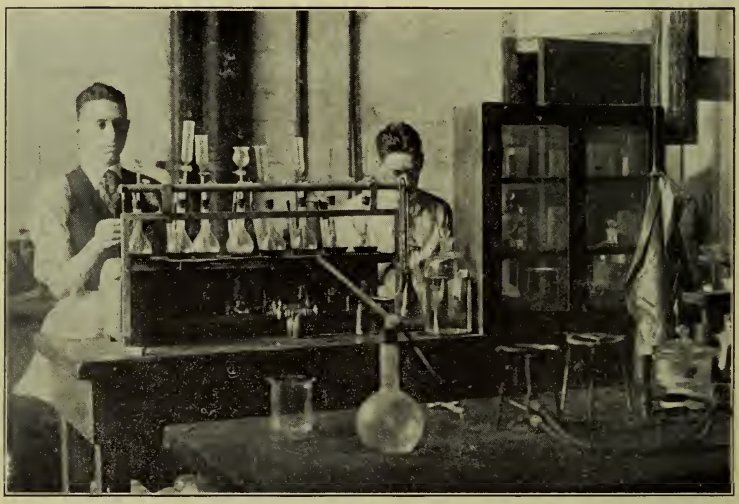
Turning Valve Parts
Sanborn Engineering Company



Setting Valves on a Corliss Engine
Class in Engineering Laboratory

# Chemical Engineering Students

Testing Road Materials
Warren Bros.—Paving Materials



Making Tensile Tests on Cast Iron
Hunt Spiller Mfg. Corp.—Iron Founders

## STUDENT ACTIVITIES

### Clubs and Teams

The student body has organized a number of groups, or clubs, and this year we have a Glee Club and Orchestra, in addition to our Basketball and Baseball Teams.

The various activities of the teams are financed by the Athletic Association of the School.

### "The CO-OP"

The students issue a monthly paper called "The CO-OP." Pertinent articles by prominent men, as well as school information, make this feature of the school activities very valuable. "The CO-OP" has met with such unqualified success since it was first published in 1916 that it will be retained as a permanent feature.

### "The Cauldron"

"The Cauldron" is the year-book of the Co-operative School and is similar to other college annuals issued by the students of most colleges and universities in the spring of each year. This publication carries the usual review of the year's work and activities, classes, socials, etc.

## PROFESSIONAL SOCIETY

The upper class students in the various courses have organized a professional society known as the Engineering Society of Northeastern College, for the closer association of the students of the School, and for the discussion and consideration of various problems and new knowledge in the Engineering Field. Meetings are held every few weeks, at which the members are addressed by engineers and other men of prominence. There are four sections of the society, one for each course in the School, namely: The Civil Engineering Section, the Mechanical Engineering Section, the Electrical Engineering Section, the Chemical Engineering Section. All students who have been in School at least one year are eligible for membership in the Society.

## REQUIREMENTS FOR GRADUATION

To receive the diploma of the School the student must attend the School not less than two years, which must be those immediately preceding his graduation. He must complete the prescribed studies of the four years, and must, also, pass final examinations, if required, on subjects pertaining especially to his course. In addition to this, he must complete satisfactorily a schedule of Engineering practice under the supervision of the Faculty.

In all courses, except course IV, the student must, also, prepare a thesis on some subject included in his course of study, or an account of some research made by him, or an original report upon some machine, a work of engineering, or an industrial plant. This thesis, or design, must be approved by the Dean. Theses are to be written on one side only of paper of good quality, 8 x 10½ inches in size, with an inch margin on each side. Theses must be handed to the Dean not later than the day on which the first annual examination occurs. All theses, and records of work done in preparation of theses, are the permanent property of the School.

The diploma of the School represents not only the formal completion of the subjects in the selected course of study, but also the attainment of a satisfactory standard of general efficiency. Any student who does not show in the fourth-year work of his course that he has attained such a standard, may be required, before receiving his diploma, to take such additional work as shall prove his ability.

## POSITIONS HELD BY GRADUATES

The graduates of the School have been able to secure positions of the same grade, commanding the same salaries, as the graduates of other good technical schools. Some of them have become engineers in charge of construction, some electrical engineers, some designing draftsmen; some have been employed by the State, or Federal Government, under Civil Service, and still others have gone into teaching. The success of those who have been graduated from the School is the best evidence of the value and thoroughness of the training offered.

# Courses of Study

## General Statement

The schedules of the various courses are given on the following pages. The first year, it will be observed, is practically the same in all courses. A few exceptions are made in courses where students need some special elementary training in their professional subjects, in order that they may be of more use to their employers in their Engineering Practice.

The school year comprises twenty weeks of class work for each division. The twenty weeks are divided into two terms of ten weeks each, and the subjects in the Course Outlines on the following pages have been arranged by terms. Opposite these subjects will be found the number of hours of class work in recitation, laboratory, or the drawing room, as well as the hours of outside preparation, that have been assigned as the minimum weekly requirement for each subject.

The number in parenthesis, following the subject in the "Outlines of Courses," is the number by which that subject is identified in the descriptive matter under "Subjects of Instruction."

The work is so planned that the student will be required to spend from 50 to 60 hours in preparation and class work during each school week.

When a student elects a course, he is required to complete all subjects in that course not indicated as "Optional," in order to receive a diploma. No subject is to be dropped, or omitted, without the consent of the Committee on Scholarship and the approval of the Dean.

## CIVIL ENGINEERING

The purpose of this Course is to give the student a broad education in those subjects which form the basis of all branches of technical education, and a special training in those subjects comprised under the term "Civil Engineering." It is designed to give the student sound training, both theoretical and practical, in the sciences upon which professional practice is based.

Civil Engineering covers such a broad field that no one can become expert in its whole extent. It includes Topographical Engineering, Municipal Engineering, Railroad Engineering, Structural Engineering, and Hydraulic and Sanitary Engineering. It covers land surveying, the building of railroads, harbors, docks and similar structures; the construction of sewers, waterworks, roads, and streets; the design and construction of girders, roofs, trusses, bridges, buildings, walls, foundations, and all fixed structures. All of these branches of Engineering rest, however, upon a relatively compact body, of principles, and in these principles the students are trained by practice in the class room, drawing room, the field, and the testing laboratory.

The course is designed to prepare the young engineer to take up the work of assisting in the design and construction of structures, to aid in the location and construction of steam and electric railways, sewerage and water supply system, and to undertake intelligently supervision of work in the allied fields of mining, architectural, and electrical engineering, and general contracting.

# I. CIVIL ENGINEERING

## FIRST YEAR

| FIRST TERM | Hours per week Ex. | Prep. | SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|---|---|---|
| Mathematics I a (10) | 6 | 6 | Mathematics I b (11) | 6 | 6 |
| Physics I (20) | 5 | 5 | Physics I | 5 | 5 |
| Descriptive Geometry I (42) | 4 | 1 | Descriptive Geometry I (42) | 4 | 1 |
| Mechanical Drawing (40) | 6 | 0 | Mechanical Drawing (40) | 6 | 0 |
| English (1) | 3 | 3 | English (1) | 3 | 3 |
| Surveying I (100) | 2 | 3 | Surveying I (100) | 2 | 3 |
| Surveying I Field and Plot (101) | 6 | 0 | Surveying I Field and Plot (1C1) | 6 | 0 |
| Physical Training (50) | 2 | 0 | Physical Training (50) | 2 | 0 |

## SECOND YEAR

| FIRST TERM | Hours per week Ex. | Prep. | SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|---|---|---|
| Surveying II (102) | 2 | 2 | Surveying II (102) | 2 | 2 |
| Surveying II, Field and Plot (103) | 6 | 0 | Surveying II, Field and Plot (103) | 6 | 0 |
| Applied Mechanics (200) | 3 | 4½ | Applied Mechanics (200) | 3 | 4½ |
| Physics II (22) | 3 | 3 | Physics II (22) | 3 | 3 |
| Physics Laboratory (23) | 2 | 2 | Physics Laboratory (23) | 2 | 2 |
| Mathematics II a (12) | 5 | 5 | Mathematics II b (13) | 5 | 5 |
| Elementary Electricity (301) | 2 | 2 | Elementary Electricity (301) | 2 | 2 |
| Descriptive Geometry II (43) | 2 | 0 | Descriptive Geometry II (43) | 2 | 0 |
| Mechanism (210) | 3 | 3 | Structural Drawing (120) | 3 | 0 |
| Physical Training (50) | 2 | 0 | Physical Training (50) | 2 | 0 |

## THIRD YEAR

| FIRST TERM | Hours per week Ex. | Prep. | SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|---|---|---|
| Railroad Curves (110) | 3 | 4½ | *Railroad Curves (110) | 3 | 4½ |
| Railroad Eng. Field and Draw. (111) | 6 | 0 | †Railroad Earthwork (110A) | 3 | 4½ |
| Highway Engineering (112) | 2 | 2 | Railroad Eng. Field and Draw. (111) | 6 | 0 |
| Strength of Materials (201) | 3 | 4½ | Theory of Structures I (130) | 3 | 4½ |
| Hydraulics (170) | 3 | 4½ | Geology (190) | 2 | 2 |
| Applied Electricity (310) | 2 | 2 | Strength of Materials (201) | 3 | 4½ |
| Applied Electricity Lab. (311) | 3 | 2 | Hydraulics (170) | 2 | 3 |
| Heat Engineering (230) | 3 | 4½ | Applied Electricity (310) | 2 | 2 |
| Chemistry (402) | 3 | 3 | Applied Electricity Lab. (311) | 3 | 2 |
| Engineering Conference (500) | 1 | 0 | Heat Engineering (230) | 3 | 4½ |
| | | | Engineering Conference (500) | 1 | 0 |

## FOURTH YEAR

| FIRST TERM | Hours per week Ex. | Prep. | SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|---|---|---|
| Structural Design (140) | 6 | 0 | Structural Design (140) | 6 | 0 |
| Theory of Structures II (131) | 6 | 12 | Theory of Structures II (131) | 6 | 12 |
| Concrete Structures (150) | 2 | 2 | Concrete Structures (150) | 2 | 2 |
| Concrete Design (151) | 3 | 0 | Concrete Design (151) | 3 | 0 |
| Plate Girder Design (132) | 2 | 4 | Foundations (165) | 2 | 2 |
| Materials (160) | 3 | 3 | Sanitary Engineering (180) | 3 | 3 |
| Hydraulic Engineering (174) | 3 | 3 | Testing Materials Lab. (255) | 2 | 0 |
| Engineering Conference (500) | 1 | 0 | Engineering Conference (500) | 1 | 0 |
| Thesis | 3 | 0 | Thesis | 6 | 0 |

*First three weeks.
†Last seven weeks.

## MECHANICAL ENGINEERING

The Mechanical Engineering course is designed to give the student a broad foundation in those fundamental subjects which form the basis for all professional engineering practice, and especially to equip the young engineer with a knowledge of the various phases of Mechanical Engineering. The course embrases instruction by text-book, lecture, laboratory, and work-shop practice, with special reference to the following branches: Applied Mechanics, Heat Engineering, Industrial Engineering, Hydraulic Engineering, Applied Electricity, and Machine Design.

The instruction aims to develop in the student the ability to think clearly and logically in the application of fundamental principles to engineering problems. The class-room work in the professional subjects is arranged with due regard to modern industrial conditions, in order that the student may connect theory with practice and appreciate the necessity of both in order to become a successful engineer. With this in view, special courses are given involving a discussion of problems which have presented themselves to the students and requiring a familiarity with the contents of current engineering periodicals. At all times it is sought to develop self-confidence in the student, and he is encouraged to take the initiative.

# II. MECHANICAL ENGINEERING

## FIRST YEAR

| FIRST TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Mathematics I a (10) | 6 | 6 |
| Physics I (20) | 5 | 5 |
| Descriptive Geometry I (42) | 4 | 1 |
| Mechanical Drawing (40) | 9 | 0 |
| English (1) | 3 | 3 |
| Chemistry (402) | 3 | 3 |
| Physical Training (50) | 2 | 0 |

| SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Mathematics I b (11) | 6 | 6 |
| Physics I (20) | 5 | 5 |
| Descriptive Geometry I (42) | 4 | 1 |
| Mechanical Drawing (40) | 12 | 0 |
| English (1) | 3 | 3 |
| Physical Training (50) | 2 | 0 |

## SECOND YEAR

| FIRST TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Mechanism (210) | 3 | 3 |
| Mechanical Eng. Drawing (220) | 9 | 0 |
| Descriptive Geometry II (43) | 2 | 0 |
| Mathematics II a (12) | 5 | 7½ |
| Physics II (22) | 3 | 3 |
| Physics Laboratory (23) | 2 | 2 |
| Applied Mechanics (200) | 3 | 4½ |
| Elements of Electricity (301) | 2 | 2 |
| Physical Training (50) | 2 | 0 |

| SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Mechanism (210) | 1 | 1 |
| Mechanical Eng. Drawing (220) | 9 | 0 |
| Descriptive Geometry II (43) | 2 | 0 |
| Mathematics II b (13) | 5 | 7½ |
| Physics II (22) | 3 | 3 |
| Physics Laboratory (23) | 2 | 2 |
| Applied Mechanics (200) | 3 | 4½ |
| Elements of Electricity (301) | 2 | 2 |
| Precision of Measurements (25) | 1 | 1 |
| Physical Training (50) | 2 | 0 |

## THIRD YEAR

| FIRST TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Heat Engineering (230) | 3 | 4½ |
| Strength of Materials (201) | 3 | 4½ |
| Machine Drawing (221) | 9 | 0 |
| Applied Electricity (310) | 2 | 2 |
| Applied Electricity Lab. (311) | 3 | 2 |
| Hydraulics (170) | 3 | 4½ |
| Power Plant Equipment (235) | 2 | 1 |
| Engineering Conference (500) | 1 | 0 |

| SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Heat Engineering (230) | 3 | 4½ |
| Strength of Materials (201) | 3 | 4½ |
| Machine Drawing (221) | 9 | 0 |
| Applied Electricity (310) | 2 | 2 |
| Applied Electricity Lab. (311) | 3 | 2 |
| Hydraulic (170) | 2 | 3 |
| Foundry Practice (237) | 1 | 0 |
| Geology (190) | 2 | 2 |
| ‡Surveying (101A) | 3 | 0 |
| Engineering Conference (500) | 1 | 0 |

## FOURTH YEAR

| FIRST TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Machine Design, Statics and Dynamics (225) | 9 | 6 |
| Industrial Plants (236) | 6 | 6 |
| Journals and Reports (240) | 1 | 3 |
| Engineering Laboratory (250) | 2 | 2 |
| Concrete Structures (150) | 2 | 2 |
| Concrete Design (151) | 3 | 0 |
| Materials (160) | 3 | 3 |
| Engineering Conference (500) | 1 | 0 |
| Thesis | 3 | 3 |

| SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Machine Design, Statics and Dynamics (225) | 9 | 6 |
| Industrial Plants (236) | 4 | 4 |
| Journals and Reports (240) | 1 | 3 |
| Testing Materials Lab. (255) | 2 | 0 |
| Concrete Structures (150) | 2 | 2 |
| Concrete Design (151) | 3 | 0 |
| Standard Engineering Products and Processes (260) | 3 | 3 |
| Engineering Conference (500) | 1 | 0 |
| Thesis | 6 | 3 |

‡For three weeks only.

## ELECTRICAL ENGINEERING

Probably none of the branches of scientific knowledge has been so markedly modified during the past decade as that relating to Electricity, nor has any other exerted such a profound influence upon the scientific thought of the period. A science, like a planet, grows in the main by a process of infinitesimal accretion. Its theory is built like a cathedral through the addition by many builders of many different elements, and this is pre-eminently true of Electricity. It is absolutely essential that the Electrical Engineer who hopes to make a success of his work should be able to grasp readily and absorb effectively the meaning and content of the many scientific memoirs recording the results of research bearing upon and directly influencing his chosen branch of Engineering.

He must have a thorough appreciation of physical theory, a clear understanding of chemical principles, and a broad working knowledge of mathematics. It is essential that each student planning to take this course should realize the fundamental necessity of obtaining a solid grounding in these three subjects upon which the success of his future work will definitely hinge, nor can he be too strongly urged to include Physics in his High school preparatory course if he hopes to avoid difficulty in the earlier years.

It is not the purpose of the course to attempt the impossible in aiming to turn out electrical engineers fully trained in all the branches of the science, especially as it is becoming daily more differentiated and specialized. The course is designed rather to lay a broad and secure foundation for future progress along the lines of activity which may particularly appeal to each individual student and give him a good working knowledge of the essential principles which underlie each of the more specialized branches of professional work.

Parallel with the theoretical work, runs a carefully planned course of laboratory instruction which is intended to develop the student's power of accurate observation, of planning work and methods of procedure for himself with due regard to saving of time and labor and precision of the results attained.

For more detailed information the reader is referred to the paragraphs descriptive of the several courses as found in the Synopsis of Studies below.

# III. ELECTRICAL ENGINEERING

## FIRST YEAR

| FIRST TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Mathematics I a (10) | 6 | 6 |
| Physics I (20) | 5 | 5 |
| Chemistry (402) | 3 | 3 |
| Descriptive Geometry I (42) | 4 | 1 |
| Mechanical Drawing (40) | 6 | 0 |
| English I (1) | 3 | 3 |
| Physical Training (50) | 2 | 0 |

| SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Mathematics I b (11) | 6 | 6 |
| Physics I (20) | 5 | 5 |
| Elements of Electrical Engineering (300) | 3 | 3 |
| Descriptive Geometry I (42) | 4 | 1 |
| Mechanical Drawing (40) | 6 | 0 |
| English I (1) | 3 | 3 |
| Physical Training (50) | 2 | 0 |

## SECOND YEAR

| FIRST TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Direct Current Machinery (320) | 4 | 4 |
| Direct Current Mach. Lab. (321) | 7 | 0 |
| Mathematics II a (12) | 5 | 5 |
| Physics II (22) | 3 | 3 |
| Physics Laboratory (23) | 2 | 2 |
| Applied Mechanics (200) | 3 | 4½ |
| Mechanism (210) | 3 | 3 |
| Mechanical Eng. Drawing (220) | 3 | 0 |
| Physical Training (50) | 2 | 0 |

| SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Direct Current Machinery (320) | 5 | 5 |
| Direct Current Mach. Lab. (321) | 7 | 0 |
| Mathematics II b (13) | 5 | 5 |
| Physics II (22) | 3 | 3 |
| Physics Laboratory (23) | 2 | 2 |
| Applied Mechanics (200) | 3 | 4½ |
| Machine Drawing (221) | 3 | 0 |
| Precision of Measurements (25) | 1 | 1 |
| Physical Training (50) | 2 | 0 |

## THIRD YEAR

| FIRST TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Alternating Currents (330) | 5 | 5 |
| †Alternating Current Lab. (331) | 6 | 3 |
| †Direct Current Testing Lab. (322) | 6 | 3 |
| Electrical Measurements (340) | 2 | 2 |
| Electrical Measurements Lab. (341) | 3 | 3 |
| Heat Engineering (230) | 3 | 4½ |
| Hydraulics (170) | 3 | 4½ |
| Strength of Materials (201) | 3 | 4½ |
| Engineering Conference (500) | 1 | 0 |

| SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Alternating Currents (330) | 5 | 5 |
| †Alternating Current Lab. (331) | 6 | 3 |
| †Direct Current Testing Lab. (322) | 6 | 3 |
| Electrical Measurements (340) | 2 | 2 |
| Electrical Measurements Lab. (341) | 3 | 3 |
| Heat Engineering (230) | 3 | 4½ |
| Hydraulics (170) | 2 | 3 |
| Geology (190) | 2 | 2 |
| **Surveying (101A) | 3 | 0 |
| Engineering Conference (500) | 1 | 0 |

## FOURTH YEAR

| FIRST TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Alt. Current Machinery (350) | 6 | 6 |
| Alt. Current Mach. Lab. (351) | 6 | 3 |
| Generation, Transmission and Utilization of Power (360) | 4 | 6 |
| Advanced Electricity (370) | 2 | 2 |
| Engineering Laboratory (250) | 2 | 2 |
| Materials (160) | 3 | 3 |
| Engineering Conference (500) | 1 | 0 |
| Thesis | 3 | 3 |

| SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|
| Alt. Current Machinery (350) | 6 | 6 |
| Alt. Current Mach. Lab. (351) | 6 | 3 |
| Generation, Transmission and Utilization of Power (360) | 4 | 6 |
| Advanced Electricity (370) | 2 | 2 |
| Testing Materials Lab. (255) | 2 | 0 |
| Standard Eng. Products and Processes (260) | 3 | 3 |
| Engineering Conference (500) | 1 | 0 |
| Thesis | 6 | 3 |

†Come on alternate bi-weekly periods.
**Four weeks course only.

## CHEMICAL ENGINEERING

The war has taught us that all industry is more or less chemical in character. All manufacturing industries are chemical to a greater or less degree, and that for their successful prosecution the chemical engineer is an essential factor. Owing to the keen competition upon commercial nations, the chemist must face bigger problems and larger responsibilities for the proper utilization and conservation of our resources. For these reasons the course in chemical engineering has for its purpose the training of students competent to take responsible places in the operation of industries based on chemical principles. During their course the students are employed in chemical industries, such as gas manufacturing plants, chemical engineering companies, etc. They not only get an excellent training in the theory of such work in school, but also a knowledge of the commercial side of the industry as well. The class work includes training in Inorganic, Analytical, Organic, Industrial, and Physical Chemistry, which is accompanied by appropriate laboratory work.

In addition to the foregoing subjects, the student is given a good knowledge of mechanical and electrical subjects, such as Drawing, Mechanism, Applied Mechanics, Applied Electricity, etc., which are given so that they have special bearing on the work of the Course.

# IV. CHEMICAL ENGINEERING

## FIRST YEAR

| FIRST TERM | Hours per week Ex. | Prep. | SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|---|---|---|
| Mathematics I a (10) | 6 | 6 | Mathematics I b (11) | 6 | 6 |
| Physics I (20) | 5 | 5 | Physics I (20) | 5 | 5 |
| Descriptive Geometry I (42) | 4 | 1 | Descriptive Geometry I (42) | 4 | 1 |
| Mechanical Drawing (40) | 6 | 0 | Mechanical Drawing (40) | 6 | 0 |
| English (1) | 3 | 3 | English (1) | 3 | 3 |
| Inorganic Chemistry (400) | 4 | 4 | Inorganic Chemistry (400) | 4 | 4 |
| Inorganic Chemistry Lab. (401) | 6 | 0 | Inorganic Chemistry Lab. (401) | 6 | 0 |
| Physical Training (50) | 2 | 0 | Physical Training (50) | 2 | 0 |

## SECOND YEAR

| FIRST TERM | Hours per week Ex. | Prep. | SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|---|---|---|
| Qualitative Analysis (410) | 2 | 4 | Qualitative Analysis (410) | 2 | 4 |
| Qualitative Analysis Lab. (411) | 6 | 0 | Qualitative Analysis Lab. (411) | 6 | 0 |
| Mathematics II a (12) | 5 | 5 | Mathematics II b (13) | 5 | 5 |
| Physics II (22) | 3 | 3 | Physics II (22) | 3 | 3 |
| Physics Laboratory (23) | 2 | 0 | Physics Laboratory (23) | 2 | 0 |
| Applied Mechanics (200) | 3 | 4½ | Applied Mechanics (200) | 3 | 4½ |
| Mechanical Eng. Drawing (220) | 6 | 0 | Machine Drawing (221) | 6 | 0 |
| Elements of Electricity (301) | 2 | 2 | Elements of Electricity (301) | 2 | 2 |
| Mechanism (210) | 3 | 3 | Precision of Measurements (25) | 1 | 1 |
| Physical Training (50) | 2 | 0 | Physical Training (50) | 2 | 0 |

## THIRD YEAR

| FIRST TERM | Hours per week Ex. | Prep. | SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|---|---|---|
| Quantitative Analysis (420) | 2 | 4 | Technical Analysis (430) | 2 | 4 |
| Quantitative Analysis, Lab. (421) | 6 | 0 | Technical Analysis, Lab. (431) | 6 | 0 |
| Organic Chemistry (440) | 3 | 3 | Organic Chemistry I (440) | 3 | 3 |
| Organic Chemistry, Lab. (441) | 6 | 0 | Organic Chemistry I, Lab. (441) | 6 | 0 |
| Heat Engineering (230) | 3 | 4½ | Heat Engineering (230) | 3 | 4½ |
| Applied Electricity (310) | 2 | 2 | Applied Electricity (310) | 2 | 2 |
| Applied Electricity, Lab. (311) | 3 | 2 | Applied Electricity, Lab. (311) | 3 | 2 |
| Strength of Materials (401) | 3 | 4½ | German I (490) | 3 | 3 |
| Hydraulics (170) | 3 | 4½ | Geology (190) | 2 | 2 |
| Engineering Conference (500) | 1 | 0 | Engineering Conference (500) | 1 | 0 |

## FOURTH YEAR

| FIRST TERM | Hours per week Ex. | Prep. | SECOND TERM | Hours per week Ex. | Prep. |
|---|---|---|---|---|---|
| Industrial Chemistry (450) | 3 | 3 | Industrial Chemistry (450) | 3 | 3 |
| Industrial Chemistry, Lab. (451) | 6 | 0 | Industrial Chemistry, Lab. (451) | 6 | 0 |
| Chemical Engineering (460) | 3 | 3 | Chemical Engineering (460) | 3 | 3 |
| Organic Chemistry II (442) | 2 | 2 | Organic Chemistry II (442) | 2 | 2 |
| Organic Chemistry II, Lab. (443) | 6 | 0 | Theoretical Chemistry (470) | 2 | 2 |
| Theoretical Chemistry (470) | 3 | 3 | Experimental Problems (480) | 10 | 4 |
| Theoretical Chemistry, Lab. (471) | 3 | 0 | German II (491) | 3 | 3 |
| German II (491) | 3 | 3 | Engineering Conference (500) | 1 | 0 |
| Engineering Conference (500) | 1 | 0 | | | |

# Subjects of Instruction

Instruction is given by lectures and recitations, and by practical exercises in the field, in the laboratories, and in the drawing rooms. A great value is set upon the educational effect of these exercises, and they form the foundation of each of the four courses. Text-books are used in many subjects, but not in all. In many branches the instruction given differs widely from available text-books; and in most of such cases notes on the lectures and laboratory work are issued and furnished to the students. Besides oral examinations in connection with the ordinary exercises, written examinations are held from time to time. At the close of the year, in May and June, general examinations are held.

In the following pages will be found a more or less detailed statement of the scope, as well as the method of instruction, of the subjects offered in the various courses. The subjects are classified, so far as possible, related studies being arranged in sequence.

The subjects are numbered, or numbered and lettered, for convenience of reference in consulting the various Course schedules. Since the total number of hours per term devoted to a subject sometimes varies in different courses, these hours are not in every case given in connection with the following descriptions.

The requisites for preparation include not only the subjects specified by number, but also those required as a preparation for them. The reason for this is in order that to carry on properly the more advanced subjects, the student must have become proficient in all subjects necessary for a clear comprehension of the last subject. Some studies, specified as being required in preparation, may be taken simultaneously, and must be completed before starting on more advanced work.

By careful consideration of the Course Schedules, in connection with the following Description of Subjects, the applicant for a special course may select, for the earlier part of that course, such subjects as will enable him to pursue later those more advanced subjects which he may particularly desire.

Applications for exception from the required preparation, as stated in connection with each subject described below, will be passed on by the Faculty.

The topics included in the list which follows are subject to change at any time by action of the School authorities.

## SYNOPSIS OF COURSES

**1. English I**

*Preparation: an acceptable high school course in English*

English Composition. English I is an elementary course especially adapted to the needs of men who expect to follow the engineering profession. Canby's English Composition in Theory and Practice forms the basis of the course. The work consists of lectures, recitations, class discussions, weekly themes, occasional impromptu themes in the class room, oral themes, and a limited amount of outside reading, particularly in modern scientific journals. The material for the themes, both oral and written, is drawn mainly from the student's study in the laboratory, or from his experiences in his Engineering Practice with the co-operating firm.

**2. English II**

Review Course. (First half year). English II is designed to help all men who, after taking the first year's work, are still, in the instructor's opinion, weak in English. It is essentially a review of English I, and is recommended to men who failed to receive a grade of 69% in that course, and is required of such men before they may elect English III.

**3. English III**

*Preparation: English I*

English for Engineers. English III offers an opportunity for upper-classmen who feel the need of a more intensive training in English to get further instruction in practical composition. The material of the course is wholly technical and deals particularly with engineering problems. Reports and business letters receive especial attention. The course will be given only when a sufficient number of Juniors and Seniors express their desire to enroll for it.

**4. English IV**

Oral English for Engineers. English IV deals wholly with the problems of spoken English which confront engineers. It offers practice in Exposition and Argumentation, on subjects relating to Engineering Practice. The work will consist of oral reports, explanations of technical processes for the understanding of the untechnically trained mind, debates on argumentative points, and class discussions. Some attention will be paid to the corrrection of faults in voice production and the elimination of mannerisms in speech and delivery. The course will be given if a sufficient number of students desire to take it. It is elective to all men who have passed English I with a grade of 70% or better.

**10. Mathematics I a**

*Preparation: Algebra, Plane Geometry*

The first part of this course is devoted to a review of Algebra and Geometry. The topics studied in Algebra are: Affected quadratic equations, fractional and negative powers and indices, the binomial theorem, and rationalizing denominators. The Geometry includes the study of mensuration of plane and solid figures.

The main part of the course, Mathematics Ia is devoted to the study of Plane Trigonometry, including circular measure, co-ordinates, trigonometric ratios, solution of the right and oblique triangles, law of sines, law of cosines, and law of tangents, goniometry, and the application of Trigonometry to problems in Physics and Engineering.

The student is also given considerable practice in the use of logarithms as applied to exponential equations, variation, and other calculations occurring in Engineering Practice.

**11. Mathematics I b**

This course is a study of Plane Analytic Geometry as a preparation for Calculus. The subjects discussed include the straight lines, the conics, and loci problems. The student learns the methods of plotting curves, both in rectangular and polar co-ordinates, and of obtaining properties of curves from their equations. The course also includes the plotting of trigonometric, logarithmic, and exponential functions.

**12. Mathematics II a**

The course is devoted to the study of Differential and Integral Calculus, rate of increase, differentiation of algebraic, trigonometric and logarithmic functions, problems in maxima and minima by differentiation with practical applications, integration, definite integrals, calculation of areas, mean value, and center of gravity.

**13. Mathematics II b**

This is a continuation of Mathematics II a. The course covers the calculation of volumes, moments of inertia, double and triple integrals in finding areas and volumes, use of integral tables and the application of calculus to problems in Engineering.

**20. Physics I**

This course consists of a study of general mechanics, statics and dynamics. The subjects studied are: equilibrium of bodies acted upon by parallel forces, equilibrium of bodies acted upon by concurrent forces, uniform velocity; uniformly accelerated motion; motion of bodies projected vertically, horizontally and obliquely, Atwood's machine, incline plane, friction, energy, work, horse-power, angular velocity and acceleration, kinetic energy of rotation, centrifugal force, fluid pressure, hydrometers, and Archmides' principle. It is the purpose of the course to lay a thorough foundation for subsequent study of experimental and technical physics. Hence it is planned with immediate reference to familiarize the pupil with the fundamental principles of the science.

**22. Physics II**

*Preparation: 20*

This course consists of a continuation of Physics I in the study of Optics and Heat. It includes the study of mirrors, refraction, lenses, optical instruments, dispersion, interference, diffraction and polarization of light. A study is also made of Thermometry, calorimetry, change of state, conduction and radiation, mechanical equivalent of heat, efficiency of engines, and Carnot's cycle.

**24. Physics Laboratory**

The work in this course consists of a series of experimental exercises given in the second year, performed by each student. The experiments supplement the lecture and class room work in Physics I and Physics II. The experiments on Mechanics include the use of verniers, micrometers, and spherometers, calculation of true weights, determination of specific gravity of solids by various methods, and motion on an inclined plane.

The experiments on Optics include the determination of radii of curvature and indices of refraction of lenses, the position of images in combinations of lenses, and the uses of the Spectrometer and Spectroscope. The experiments on Heat include the calibration of a thermometer, determination of temperature of a mixture, area of indicator diagrams by the planimeter, the relation between the pressure and boiling point of water, and the use of the air thermometer.

**25. Precision of Measurements**

*Preparation: 10, 11*

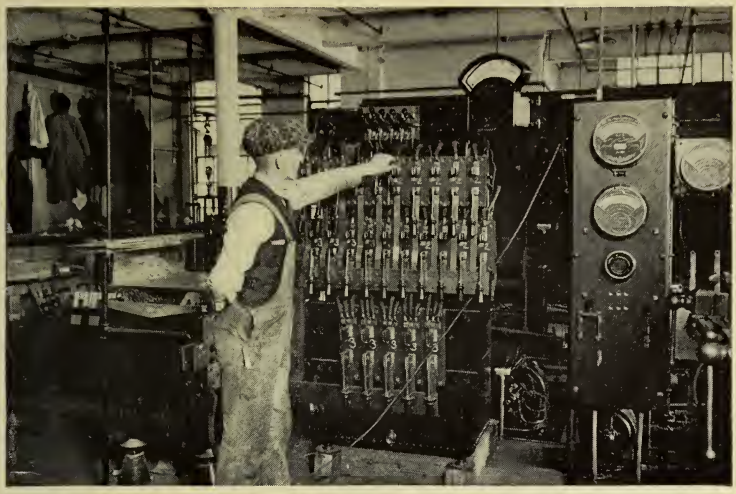
This course, which is required of all students in the second half of the second year, comprises a thorough discussion of the fundamentals of the Theory of Measurements, including a study of the Sources of Error, the Best Representative Value of the result of a series of measurements, the determination of the several Precision Measures of the result of one's work, the converse problem of how best to proceed in order to reach a given degree of precision, and a thorough consideration of the proper use of Significant Figures.

**40. Mechanical Drawing**

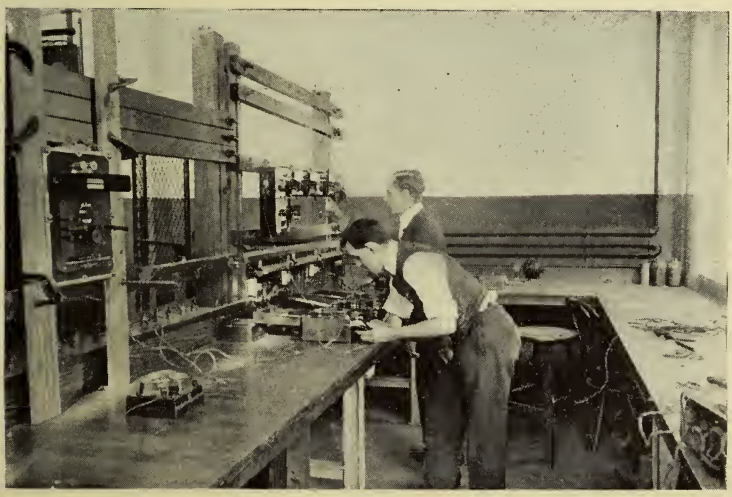
This course extends throughout the first year, and is taken by first year students in all Engineering Courses. The work is planned on the assumption that the student understands simple geometrical construction as studied in plane geometry.

It consists of exercises in the proper use and care of drafting tools; a thorough study of the principles of orthgraphic projection with applied problems relating to engineering drawing. Special attention is given to lettering, tracing, and dimensioning.

# Electrical Engineering Students

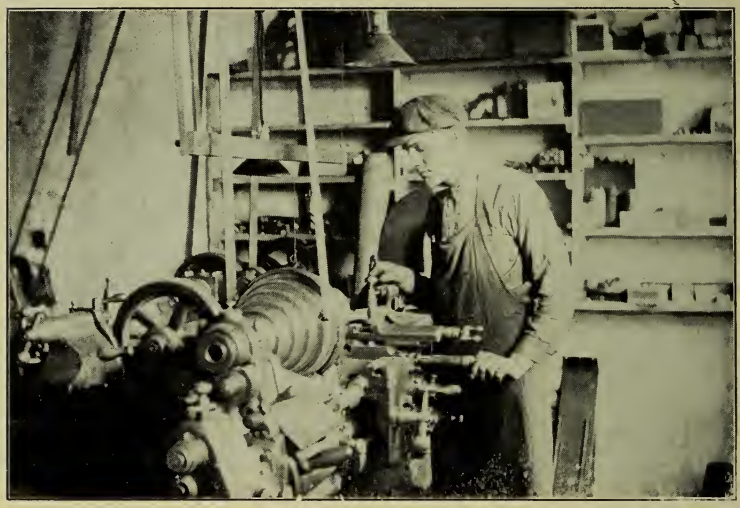


Testing a 10,000 Ampere Storage Battery Control Panel
Condit Electrical Mfg. Co.



Testing Meters
Edison Electric Illuminating Co.

# Mechanical Engineering Students



Operating a Lathe
H. G. Butt Mfg. Company

Wood Working
Pattern Shop—Boston Elevated Railway Co.

**42. Descriptive Geomtry I**

Beginning with an explanation of the meaning and value of the subject, a study is made of the representation of simple solids, then lines and planes and the elementary problems relating to the same. Later in the course, the work includes the more important relations between lines and planes and solids, embracing sections and developments. Practical problems, isometric drawing, and oblique projections are given.

**43. Descriptive Geometry II**

*Preparation: 42*

The course is a continuation of Descriptive Geometry I, and deals with single and double curved surfaces; their intersection by oblique planes; tangent planes, penetrations, development, and so forth. Various practical problems are given to illustrate the applications of the principles studied.

**50. Physical Training**

A special arrangement has been made with the Department of Recreation and Health whereby it is possible for any students in the School who desire it to get the Senior privileges of the gymnasium and natatorium, from one to six P. M. daily, upon the payment of five dollars for either gymnasium or natatorium privilege or seven dollars and fifty cents for both privileges. However, the School shares the expenses and the students are required to pay only two dollars and fifty cents for the gymnasium privilege.

**100. Surveying I**

*Preparation: 10, 11*

This course consists of two lectures, or recitations, per week during the first year in which the following are taken up: the theory of the chain, tape, compass, transit and level, and their adjustments; the method of measuring traverses for

area, and location of artificial features, buildings, and fences; such details as crooked boundaries, city surveying, and deeds of property; the method of running profile and grade lines; the computation of traverses and areas; the use of contour maps in road location and drainage; and the U. S. system of public land surveying.

**101. Surveying I (Field Work and Plotting)**

*Preparation: 100*

This course is taken simultaneously with Surveying I, and consists of six hours of exercise per week, throughout the first year. The student is taught the use of the chain, tape, compass, transit, and various forms of leveling instruments in the field. The work in the drawing room consists in making computations and scale drawings of a compass survey, transit survey, and the layout of a city block, by the methods best adapted to the plotting of these various surveys.

**101A. Surveying (Fieldwork)**

This is a brief course in surveying fieldwork for students taking Courses II and III, to give them instruction in the essential principles of surveying practice, including the use of the transit, level and other instruments.

**102. Surveying II**

*Preparation: 100, 101*

This is a continuation of Surveying I, and consists of two lectures or recitations per week, throughout the second year. The student is taught the theory of plan and geodetic triangulation as a basis for surveys of extended areas, including methods of measuring a base line accurately and the corrections to be applied to observed measurements. Then the methods of filling in topographic details are studied. This work includes the theory and use of the stadia and plane table, photographic surveying, and barometric and trigonometric leveling. Astronomical observations for the determination of latitude, longitude, and azimuth form a necessary part of the course, and a brief consideration of hydrographic and mine surveying complete the year's work.

**103. Surveying II (Fieldwork and Plotting)**

*Preparation: 102*

This course is taken simultaneously with Surveying II, and consists of six hours of exercise per week throughout the second year. The field work in the fall is devoted to making topographic surveys by stadia and plane table. During the winter the notes taken are plotted, as well as other drawing room problems, such as a plot of a photographic survey and a mine survey. This is supplemented by some astronomical observations during the short winter days. In the spring, the time is devoted to barometric and sextant observations, and if time permits, a little work in triangulation.

**110. Railroad Curves**

*Preparation: 100, 101*

This course consists of three hours of exercise a week throughout the first thirteen weeks of the third year. A thorough study is made of the mathematics of circular, parabolic, and spiral curves, and their application to practical work. Particular attention is given to compound curves. The practical applications considered are mostly in connection with railroad location and alignment, but the methods can be applied with slight changes to highway and pipe line location. The course might almost be considered as a course in railroad design and location, since the many problems occurring in preliminary and location surveys form the basis of the class room work. It is obvious that the problems of location will appear at the points where the direction of the line changes; hence the necessity for a thorough understanding of the possibilities of curves as an essential part of the training of a railway engineer.

**110A. Railroad Earthwork**

*Preparation: 110*

This is a continuation of Railroad Curves 110, and consists of three exercises a week, for the last seven weeks of the third year. The course is designed to give the student a good working knowledge of the various methods of staking out and computing earthwork, special attention being paid

to railroad cross-sections. Particular consideration is also given to the source of inaccuracy introduced by the ordinary methods of computing, and the various practical considerations which may render these methods as precise in the long run as the more refined methods. The relative importance of earthwork in the railways of the country has been shown recently by the great amount of time needed to measure it during the course of the federal physical valuation of the railways. This has resulted in an increased interest in the matter on the part of railway engineers, and the adoption of some new methods designed to secure increased speed in field or office work.

**111. Railroad Fieldwork and Drawing**

*Preparation: 110 and 110A*

This course consists of six hours of exercise a week throughout the third year. In the fall fieldwork, a reconnoissance is first made of a railroad about a mile and a half in length, followed by a preliminary survey, with transit and level, as a basis for fixing the location survey. All this work follows modern practice in laying out railroads. Practice is given in taking topography by hand level and top, and also by stadia and plane table. The fieldwork in the spring is devoted to a systematic drill in running curves of various kinds, including transition curves, and in staking out earthwork. The drawing consists in plotting the preliminary survey of the railroad surveyed. Following this, a problem in contour location is studied in detail.

**112. Highway Engineering**

*Preparation: 110*

This course consists of two lectures, or recitations, a week, during the first term of the third year. The subjects considered are the location, construction, and maintenance of roads, street design, and street drainage, sidewalks, pavement foundations, and the construction, cost, and maintenance of the various kinds of roads and pavements, including asphalt brick, cobblestone, stone-block, and wood-block, macadam, both water bound and bituminus, bituminous concrete and hydraulic cement concrete, and gravel and earth.

The science of Highway Engineering is in a stage of transition brought about by the advent of the automobile. New materials and methods such as bituminous binders on macadam roads and the use of concrete for the wearing surface have greatly extended a field that had been rather neglected by engineers during the years immediately preceding. Consequently, today the science offers a wide field for those who care to specialize in this branch.

**120. Structural Drawing**

The course in structural drawing consists of one exercise of three hours each week in the drawing room during the second term of the second year. The time is devoted to the drawing of standard sections of structural steel shapes and connections and the preparation of drawings representing elementary structural details. This course is designed to familiarize the student with the conventional signs for riveting, riveted connections, and the dimensioning and detailing of structural parts.

**130. Theory of Structures I**

*Preparation: 201*

This is a course of thirty exercises in the second term of the third year, devoted to class and drawing-room work, in studying the loads, reactions, shears, and moments acting upon structures of various kinds, as roofs and bridges. A thorough study is also made of the various functions of the influence line; the method used to determine the position of moving loads to produce maximum shears and moments on bridges and the design of beams.

**131. Theory of Structures II**

*Preparation: 130*

This course consists of six lectures or recitations per week throughout the fourth year. It treats of the computation and design of structures of wood, steel, and masonry, by analytical and by graphical methods. The subjects considered are: roof and bridge trusses of various types, such as simple trusses, bridge trusses with secondary web systems, including the Balti-

more and Pettit trusses, and trusses with multiple web systems, lateral and portal bracing, transverse bents, viaduct towers, and cantilever bridges. A study is also made of the design of columns, tension members, pin and riveted truss joints, trestles of wood and steel, masonry dams, retaining walls, and arches. During the course the student is given training in the use of the standard handbook in structural work. The object is to train the student thoroughly in the application of mechanics to the design of structures.

**132. Plate Girder Design**

*Preparation: 201, 130*

Given two hours a week for the first half of the fourth year, this course aims to fit the student to design plate girders according to the best current engineering practice. The theory of the plate girder is first taken up and the exact and approximate method of design discussed. Rivets and riveted joints, rivet pitch, and all details involved in the design of plate girders, such as web stiffeners, connection angles, and splices of the various parts are studied. During the last exercises, a complete design of a thorough plate girder, single track, railroad bridge is made.

**140. Structural Design**

*Preparation: 131, 132*

This is a course of six hours per week throughout the fourth year, in which the students are instructed in the design of structures of wood and steel. Each student is given a set of data and is required to perform all the computations and to make designs and working drawings for structures, such as roof trusses and railroad bridges. His work is criticized as it progresses.

**150. Concrete Structures**

*Preparation: 201*

This is a course of two recitations per week. The theory of reinforced concrete is studied and applied to the design of slabs and simple beams, T-beams, columns, and footings. The practical as well as the theoretical limitations of concrete structures are considered.

**151. Concrete Design**

*Preparation: 150*

This course is taken in conjunction with the course in Concrete Structures (150) and is given in one recitation of three hours each week throughout the year. A large part of the work is done in the drafting room, where each student makes working drawings, using the results obtained in previously assigned problems. The problems assigned include the design of factories, retaining walls, masonry dams, and concrete arches.

**160. Materials**

*Preparation: 201*

This course consists of three lectures, or recitations, per week throughout the first term of the fourth year, in the study of methods of testing and the strength of various materials used by the engineer. A detailed study is also made of the methods of manufacturing, properties, and uses, of materials used in engineering work, such as lime, cement, concrete, brick, wood, stone, iron, and steel. Each student is required to prepare, and present to the class, a paper on some subject of especial importance, which is assigned by the instructor.

**165. Foundations**

*Preparation: 201*

This course consists of two lectures a week during the second half of the fourth year. The subjects treated in this course are pile foundations, including those of timber and concrete, sheet piles, coffer-dams, box and open caissons, pneumatic caissons, pier foundations in open wells, bridge piers, and abutments.

**170. Hydraulics**

In this course a study of Hydrostatics and Hydrodynamics is made. In the first term the subjects considered are: The pressures on submerged areas, together with their points of application; the flow of water through orifices, short tubes, and nozzles; and the various formulae relating to the flow of water over weirs. In the second term, the laws gov-

erning the flow of water through pipe lines and in open channels, and the dynamic pressure and work of water flowing over curved surfaces, are taken up for discussion.

**174. Hydraulic Engineering**

*Preparation: 170*

This course consists of three exercises a week throughout the first term of the fourth year. The course is devoted to a study of irrigation, in which rainfall, run-off, the design and arrangement of canals and distributaries, methods of applying water to the soil, location and capacity of reservoirs, location and construction of dams, and other special works employed in this branch of engineering, are taken up for discussion. The student is instructed in the use of hydraulic diagrams, to obtain the discharge of conduits and canals and the flow of water in open channels. Instruction is also given in the theory and practice of stream measurements, methods and instruments used in this work, and the working up and use of data obtained.

**180. Sanitary Engineering**

*Preparation: 170, 174*

The course in Sanitary Engineering consists of three exercises per week, in the second half of the fourth year. The first part of the course deals with sewerage systems and sewage disposal plants from an engineering standpoint. A study is made of the factors entering into the design of sewers for towns and cities, the design and construction of sewage disposal and sewage treatment plants, and the maintenance of the system. A short course in water supply is also given, in which is discussed the principles governing the quantity of water required for cities and towns, the determination of the run-off from drainage basins, the necessary storage to guarantee the necessary supply, the design of distribution systems, and the conditions affecting the quality of the water. On account of the limited amount of time which can be given to this course and Course 174 the subjects can not be taken up in great detail.

# Chemical Engineering Students

Testing Milk
Boston Bio-Chemical Laboratory

Class in Quantitative Analysis
Chemical Laboratory

# Civil Engineering Students

Locating Edge Stones
Whitman and Howard, Civil Engineers

Making a Stadia Survey
Class in Surveying Fieldwork

**190. Geology**

This course treats of earth movements and the various terrestrial applications of solar energy. The more important geological processes, erosion, sedimentation, deformation and eruption are taken up and discussed.

The latter part of the course is devoted to lectures on the broader structural features of the earth's crust and the application of the principles of structural geology to practical engineering problems.

**200. Applied Mechanics**

*Preparation: 12, 13, 20, 22*

The subject consists of three lectures or recitations per week throughout the second year. It comprises a study of statics, concurrent forces, parallel forces and couples, and the solution of problems with ropes, wheels, frictionless planes, hinges, stresses in frames, distributed forces, center of gravity and moment of inertia. Then follows a thorough study of kinematics and dynamics, including the equations for uniform and varying rectilinear motion, centrifugal force, work, power and kinetic energy.

**201. Strength of Materials**

*Preparation: 200*

This course comprises a study of the strength of materials, mathematically treated. In the first term the subjects studied are: The theory and experimental basis of tension, compression, shear, resilience, modulus of elasticity, and ultimate stress in engineering materials; the design of beams, including stresses produced by bending, moment and shear diagrams, longitudinal shear, the deflection; also the strength of shafts and springs. In the second term, which is taken only in the civil and mechanical engineering courses, the work is on beams with three supports, the combined stresses of bending and tension, a thorough study of columns, and the design of riveted joints and hooks.

**210. Mechanism**

This is an introductory course, conducted mainly by graphical methods, and dealing with the fundamental laws govern-

ing the velocity ratio and paths of mechanical movements and their application to velocity diagrams, simple types of gearing, and other modes of transmission.

**220. Mechanical Engineering Drawing**

This consists of study of the technique of graphic expression and its application in giving complete and accurate information to the constructor. Detailed and assembly drawings are made from freehand sketches and other data, but nothing in the nature of a copy is permitted. The work is conducted according to the methods of progressive draftsmen, the greatest emphasis being laid on completeness and accuracy in the use of graphic language.

**221. Machine Drawing**

This is a continuation of Mechanical Engineering Drawing 220, and includes a few problems in simple machine design.

**225. Machine Design**

*Preparation: 201, 221, 230*

This course aims to give the student practice in the application of theoretical principles previously studied and at the same time acquaint him with the many practical details which must be considered in design work. The problems taken up in the early part of the course are of static nature, while the later problems involve dynamical stresses. The design of some type of pressure vessel, such as a tank or a boiler, constitutes the first problem, the stresses for such a design being known with a good degree of certainty and the materials of construction very reliable. The other problems of the course vary from year to year, but the following are typical of the designs taken up: arbor press, hydraulic flanging clamp, crane, air compressor, punch and shear, stone-crusher, etc.

In each design the constructive details are carefully considered, with special attention to methods of manufacture, provision for wear, lubrication, etc. The work is based on rational rather than empirical methods, the student being re-

quired to make all calculations for determining the sizes of the various parts and all necessary working drawings.

**230. Heat Engineering**

*Preparation: 12, 13, 201*

The course includes a study of the principles of thermodynamics; a discussion of the properties of gases, saturated and superheated vapors, especially of air and steam; of the flow of fluids through orifices, nozzles, pipes and meters, a discussion of the action of the steam injector; a study of the various cycles of the hot air, internal combustion and steam engines, of the turbine, air compressor and refrigerator systems. These engineering applications are treated from the physical, analytical and graphical points of view, so as to give the student a good foundation in the principles of thermodynamics, in the solution of actual heat engineering problems. The course also includes a study of the simple, compound and multiple expansion steam engine, of the different types of gas engines, of the gas producer, of compressed air and refrigerator machines, and the methods of testing such machines.

**235. Power Plant Equipment**

*Preparation: 230, taken simultaneously*

This course is largely descriptive of the many appliances used in modern power plants. It includes a discussion of boilers and boiler accessories, ash and coal handling systems, the various types of engines, gas-engines, and turbines, with their valve gears and governing devices, condensers, feed-water heaters, etc.

**236. Industrial Plants**

*Preparation: 235*

This course covers the principles involved in the erection, installation and management of an industrial plant. A description of the different types of structures, with consideration of such details as foundations, walls, columns, floors, windows, etc., is followed by a discussion of the installation of the power plant and machinery. Principles of illumina-

tion, fire-prevention, heating and ventilation, routing of materials, and the organization and management of a plant, are taken up. A design problem is given in connection with the course.

**237. Foundry Practice**

This is a lecture course, in which is studied the general principles and practice of pattern making, taking up a consideration of sands, tools, molds, cores, ramming, venting, facing, sprucing, risers, gateing, use of chills, and simpler types of sweep molding.

**240. Journals and Reports**

This course consists of three hours a week of outside reading in standard engineering publications, with one hour per week for class discussion. The course is designed to acquaint the student with general engineering literature and to enable him to read intelligently discussions upon Mechanical Engineering Practice.

**250. Engineering Laboratory**

*Preparation: 230*

This course consists of exercises and tests upon the various forms of appliances in use in the power plant, such as:

1. Gauge test and calibration.
2. Slide valve setting.
3. Corliss valve setting.
4. Testing quality of steam by steam calorimeter.
5. Determine flow of steam through an orifice.
6. Steam engine indicator practice.
7. Test of a simple steam engine.
8. Test of a compound steam engine.
9. Study of a steam driven air compressor.
10. Test of a steam driven air compressor.
11. Series of tests on a Pelton water wheel.

Course III student omit exercises 2, 3, 8, 10 and 11.

**255. Testing Materials Laboratory**

*Preparation: 201*

The work done by the students in the Testing Materials Laboratory includes tests to determine the elongation, reduction of areas, modulus of elasticity, limit of elasticity, yield point, ultimate compressive strength of metals, such as steel, cast iron, copper and brass; tensile and compressive tests on timber and concrete; tests to determine the deflection, modulus of elasticity, elastic limit, and ultimate transverse strength of steel and wooden beams, subject to transverse loads. Tests are also made on cement mortars to determine the strength of cubes and briquettes at different ages.

**260. Standard Engineering Products and Processes**

*Preparation: 236*

This course is intended to familiarize the student with the commercial names and sizes of engineering products, such as bar and plate stock, shafting, tubing, pipes, valves, bearings and hangers, belts, pulleys, etc. A discussion of such manufacturing processes as extrusion, broaching, press work, electric and oxy-acetylene welding, cold and hot rolling, and drawing, etc., is included.

**300. Elements of Electrical Engineering**

*Preparation: 10, 20, and 400*

This is the basic course in the professional work in electrical engineering and consists of a series of twenty-seven exercises during the second term of the first year. The subjects covered are: Fundamental ideas concerning electricity, currents of electricity, electromotive force resistance and Ohm's law, electrical work and power, electrical circuits, Kirchoff's laws, principles and types of primary batteries, magnetism, electromagnetism, electromagnetic induction, self and mutual inductance, electrostatics, energy stored in the electromagnetic and electrostatic fields, and the single energy transient in direct current circuits. The practical units of measurement are discussed as the several quantities to which they apply are successively reached.

**301. Elements of Electricity**

*Preparation: 10, 20*

This is a course of forty exercises in the second year taken by all students in the Civil, Mechanical, and Chemical Engineering Courses. It is intended to give the foundation for the subsequent electrical engineering work given these students. The subjects discussed are, for the most part, the same as those in Elements of Electrical Engineering (300), but the method of treatment is more qualitative and less quantitative.

**310. Applied Electricity**

*Preparation: 301*

This is a course of forty exercises through both terms of the third year for all students in the Civil, Mechanical, and Chemical Engineering Courses. The first term is devoted to a consideration of the various direct current machines and appliances, their characteristics and applications. In the second term alternating current apparatus is treated of in the same manner. Recitations and problem work are based largely on practical applications.

**311. Applied Electricity Laboratory**

*Preparation: 301, 310 taken concurrently*

This is a course of twenty laboratory exercises throughout the year, illustrating the characteristics and operation of direct and alternating current machinery, discussed in the Applied Electricity Course. Emphasis is placed on consideration of the precision required in commercial work and students are encouraged to estimate the precision attained by the means available. A written report is required on each experiment and especial care is exercised that such reports be correct in matter and form.

**320. Direct Current Machinery**

*Preparation: 11, 300*

This course, which is given throughout the second year, consists of a series of lectures, recitations, and problems cover-

ing the general principles of direct current machines and practice. Beginning with a discussion of the magnetic properties of iron and the magnetic circuit, there is next taken up a general survey of the direct current dynamo. This is followed by an amplified discussion of the transients found in direct current inductive circuits leading to the study of armature windings, armature reactions and their compensation, commutation, generator and motor characteristics, efficiency, ratings, heating, and generator and motor testing.

In the later portion of the course the practical operation of direct current machinery is considered. Illustrative of this may be mentioned the subjects of parallel running, boosters and balancers, three wire systems, and storage batteries.

**321. Direct Current Machinery, Laboratory**

*Preparation: 320, taken concurrently*

This course of laboratory exercises running parallel with 320 is devoted to a carefully selected series of experiments intended to exemplify qualitatively and in the clearest manner the principles developed in the lecture course. The course opens with a few simple experiments intended to familiarize the student with the practical handling of ammeters, voltmeters, shunts, and millivoltmeters, and then involves a series of twenty experiments, of which the following may be mentioned as illustrative of the type of work:

The starting of a shunt motor, and starting devices.

The speed, field and voltage relations in a separately excited machine.

The heat test of a generator.

The characteristic curves of generators.

The parallel operation of shunt, and compound generators.

The three wire balancer set.

The speed and torque curves of the series motor.

Satisfactory completion of twelve experiments is the minimum acceptable amount of work.

Since the purpose of the course is in part to develop correct methods of work, it is intended that the whole of the preparatory work, as well as the working up of the data obtained, shall be done in the laboratory under the supervision of the instructor so far as necessary.

**322. Direct Current Testing, Laboratory**

*Preparation: 320 and 340, taken concurrently*

This course, which runs throughout the third year (in alternating bi-weekly periods) concurrently with 331, is given over to the quantitative testing of direct current machinery and involves testing, of which the following may be considered typical:

Stray power test of generators and motors.
Prony brake test of a motor.
Machine efficiency by retardation methods.
Machine efficiency by electrical supply of losses.
Regulations testing.
Analysis of losses.

As the course progresses the student is thrown more and more upon his own resources; a desired result is stated to him, and he is required to plan out his own methods, settle upon the apparatus needed, solve his precision requirements, calibrate his instruments if necessary, and finally turn in a detailed report covering all phases of the work.

**330. Alternating Currents**

*Preparation: 12, 13, 320*

This course is given throughout the third year, and comprises lectures, recitations, and problem work upon the electromagnetic and electrostatic fields, variable, and alternating currents. Among the subjects covered are,—solution of linear differential equations of the first and second degree with constant coefficients leading to the general equation of current in any circuit, transients and the establishment of the steady state, consideration of the steady state when the electromotive force follows the equation $e=E \sin wt$. Harmonic alternating currents complex quantity, vector representation, topographic representation, symbolic representation. Application of the principles developed to all possible combinations of resistance, inductive and condensive reactances in both single and polyphase circuits. The course is emphatically mathematical, involving the use of both Fourier series and hypobolic functions, so that thorough comprehension of the preparatory

mathematical subjects cannot be too strongly insisted upon. About two hundred problems are worked in class during the year.

**331. Alternating Currents, Laboratory**

*Preparation: 330 and 340, taken concurrently*

This is a course of laboratory exercises running throughout the third year (in alternating bi-weekly periods) concurrently with 322, and designed to elucidate practically the principles developed in the parallel course on Alternating Current 330, also to train the student in the use of special types of instruments to be used later in the laboratory work upon Alternating current machinery. Illustrative experiments are:

The study of AC series and parallel circuits, resonant conditions.

The effect of frequency change on circuit constants.

Paralleling of AC machines, synchronizing and changing load.

Determination of power factor in various circuits.

Power measurement in polyphase circuits.

**340. Electrical Measurements**

*Preparation: 25, 300, 321*

This course, given during the third year, consists of two parts; the first being intended to familiarize the student with the principal types of measuring instruments used in both commercial work and the standardizing laboratory of the Supply Company, the manner of their use, sources of error, etc.; the second, giving the principles of the fundamental methods of measuring the several electrical quantities—Resistance, Current, Electromotive Force, Capacity, Inductance, Power, and Energy.

**341. Electrical Measurements, Laboratory**

*Preparation: 340*

This course, given during the third year and running parallel with 340, consists of a series of experiments intended to bring out the principles therein developed, and involving such

matters as the determination of Specific Resistance, Insulation Resistance, Conductivity, Magnetic Induction, Electrostatic Capacity, and the use of special apparatus, such as the Kelvin Bridge, Cary-Foster Bridge, Potentiometer in the calibration of voltmeters and ammeters, etc.

Particular stress is laid on the correct use of apparatus and methods, and precision discussions are required throughout.

**350. Alternating Current Machinery**

*Preparation: 340*

This is a course of lectures, recitations, and problems devoted to a careful, thorough, and detailed discussion of the construction, theory, operating characteristics, and testing of the various types of alternating current machinery. One two-hour period a week is spent in the solution of numerical problems.

**351. Alternating Current Machinery Laboratory**

*Preparation: 330, 350, taken concurrently*

This is a laboratory course to accompany the course in Alternating Current Machinery. Three laboratory exercises are held per week. The work includes tests on the heating, efficiency, and determination of the characteristics of the various types of alternating current machinery, such as transformers, generators, and motors. A detailed preliminary study is made of each assigned experiment, involving the theoretical principles, the method of procedure to obtain the required results, and the way in which the results should be worked up. This is embodied in a preliminary report. The student then does the necessary laboratory work to obtain the required data; and finally works up the whole into a detailed final report. No more assistance than necessary is given by the instructor, the initiative and resourcefulness of the student being depended on to a very large extent.

**360. Generation, Transmission, and Utilization of Power**

*Preparation: 170, 201, 230, 320, 330, 350*

This course, given six hours weekly throughout the fourth year, begins with a detailed study of the central station, both

steam driven and hydroelectric, equally careful attention being given to the engineering and economic details, the influence of the various appliances upon the cost of power being kept constantly in view.

Following this comes a careful study of the high tension transmission line, the potentials used, spacing of conductors, line characteristics, losses, inductive effects upon neighboring circuits, quarterwave transmission surges, etc.

After this is considered the sub-station and equipment, and then follows a full discussion of distribution systems and the utilization of electrical power, especial attention being given to railway operation, and the matter of out-door and interior illumination.

Wherever necessary attention is called to the applicable requirements of the National Electrical Code and the specifications of the Bureau of Standards Electrical Safety Code.

The course closes with a brief discussion of the Public Utility in its relations to the Community served.

**370. Advanced Electricity**

This course consists of two parts. It is given throughout the fourth year and in the first term comprises a full descriptive discussion of modern electrical theory. Beginning with the state of electrical science in the time of Franklin the development of the science is traced through the work of Faraday, Maxwell, Hertz, and Kelvin on the one hand; of Weber, Crookes, J. J. Thomson, Millikan and others on the other. The subjects of metallic, electrolytic and gaseous conduction are discussed, together with ionization and the theories of electromagnetic mass and the electrical constitution of matter.

In the second term, the matter of electromagnetic radiation is considered, the propagation of waves in space and along wires and a detailed discussion of the subject of transients in modern transmission systems, together with the theory of radio transmission of energy.

**400. Inorganic Chemistry**

This is a course of two lectures and two recitations each week throughout the entire year. The fundamental principles of the science are taught by means of experimental lec-

tures. Topics of a broad general character are taken up in the first part of the course, in connection with the descriptive chemistry of the non-metallic elements, followed later by more specialized work in connection with the elements.

Recitations will include a short written quiz on the two lectures of the week. Special attention is given to chemical calculations based on practical application.

**401. Inorganic Chemical Laboratory**

This is a laboratory course of six hours per week throughout the year. The object of the course is to cultivate scientific attitude and habit of thought on the part of the student and to increase his power of acquiring knowledge, whether it be from book, lecture, or from experiment. The experiments are planned to illustrate the topics which have been discussed in the lecture room. Careful manipulations, thoroughness in observation, accuracy in arriving at conclusions, are required of each student. In this as in all subsequent laboratory work neat and satisfactory notes will be considered an essential part of the work.

**402. Chemistry**

This is a course in inorganic chemistry, consisting of three class exercises per week. The course is designed to meet the needs of students in non-chemical courses, and will include a brief discussion of the general principles of chemistry as applied to engineering, with the idea of illustrating the applications of chemistry to special lines of engineering work.

**410. Qualitative Analysis**

*Preparation: 400, 401*

A course of two class exercises a week throughout the entire year. The course is designed not merely to consider the procedures used in the detection of the common elements but to deal in a much broader way with the principles involved in chemical analysis and to broaden the student's knowledge of inorganic chemistry especially the chemistry of the metallic elements. In the latter part of the course questions

involving the analysis of unusual mixtures will be discussed with especial emphasis on the interpretation of analytical results.

**411. Qualitative Analysis Laboratory**

*Preparation: 410*

A laboratory course of 6 hours per week throughout the year. After a series of preliminary experiments illustrating principles and giving opportunity for practice in writing equations, the analysis of unknown substances is undertaken beginning with solutions and simple salts and later analyzing minerals, pigments, slags, alloys and various commercial products as boiler compounds, cleaning powders, glass, enamels and similar inorganic substances.

**420. Quantitative Analysis.**

*Preparation: 410, 411*

A course of eighteen class exercises dealing with the general principles of quantitative analysis. Half of the time is devoted to the consideration of typical methods in gravimetric analysis as the determination of chloride in salt, the analysis of ferrous sulphate for iron and the sulphate, the complete analysis of brass and other analysis involving general principles of procedure. The other half of the time is devoted to the methods of volumetric analysis as illustrated in the use of acid and alkali determinations, oxidation methods involving bichromate, permanganate and iodine and the methods of volumetric precipitation. Special attention is given to chemical calculations and the solution of numerous analytical problems is one of the most essential features of the course.

**421. Quantitative Analysis Laboratory**

*Preparation: 420*

A course of analytical practice of six hours per week in the first term of the third year illustrating the methods discussed in 144. The calibration of burettes, the use and care of analytical balances and a limited number of typical gravi-

metric and volumetric analyses are included in the course in which great stress is laid on the accuracy, care and integrity necessary for successful quantitative work.

**430. Technical Analysis**

*Preparation: 420, 421*

This course of two hours per week throughout the second term of the third year is a continuation of Course 144 but will deal more specifically with the methods of testing used in connection with industrial operations. It will include the rapid methods for steel, the analysis of boiler waters, gases, fuels, oils, paints, varnishes and similar substances.

**431. Technical Analysis Laboratory**

*Preparation: 430*

This course of six hours per week in the second term of the third year is designed to illustrate by a limited number of analyses the technical methods of quantitative analysis. Problems will be assigned individually depending on the student's future plans or his inclination and will be selected from the fields of steel analysis, gas and fuel analysis including calorific testing, water analysis, the study of pigments, soaps or in general in the analysis of that class of materials in which the student is most interested.

**440. Organic Chemistry I**

*Preparation: 420, 421*

This is the course of three class exercises per week throughout the third year. The lectures will deal with the underlying principles and theories of organic chemistry, the methods of preparation, and characteristic reactions of carbon compounds. The important organic compounds will be considered in detail, because they serve as the most convenient examples for illustrating fundamental principles which elucidate the chemical character of substances which are of practical importance.

**441. Organic Chemical Laboratory I**

*Preparation: 440*

This is a course designed to familiarize the student with the operations and apparatus, and the different kinds of laboratory technique involved in organic work, such as fractional distillation, extraction, crystallization, steam distillation, determinations of melting points, boiling points, and the like. It deals also with general methods of preparation, such as etherification, saponification suphonation, diazotization, etc.

The student will prepare a number of compounds, including nitro-benzene, aniline, ethers, phenols, and other typical organic substances.

**442. Organic Chemistry II**

*Preparation: 440*

This is a continuation of Course 440, but designed to lay special emphasis on the industrially important organic compounds, their preparation, technical uses, and methods of identification. The latter part of the course, which requires two hours per week throughout the first year, will be carried out as a seminar, the work consisting of reading in books, journals, and patent literature, followed by reports and discussions.

**443. Organic Chemical II Laboratory**

*Preparation: 442*

This is a course of six hours per week throughout the first term. It consists of preparations and reactions of typical organic substances and will include the methods of separation and identification of simple mixtures. The instruction also includes a study of the qualitative tests for the important elements occurring in organic compounds and quantitative determinations of carbon, hydrogen, and nitrogen.

**450. Industrial Chemistry**

*Preparation: 410, 420, 430, 440*

This course consists of a series of lectures and recitations upon the more important technical chemical processes. Much attention is given to the general operations common to many

industries, such as crushing, grinding, lixiviation, filtration, evaporation, distillation, crystallization, etc., and to the details of various types of apparatus used for carrying on these processes. Some of the more important manufacturing industries, such as the production of alkali, fertilizers, glass, pigments, cement, soap, explosives, paper, as well as wood distillation, the refining of petroleum, etc., are also considered in detail.

**451. Industrial Chemical Laboratory**

*Preparation: 450*

This is a course in the quantitative study of the preparation and purification of a small number of chemical products, selected as types of reactions of industrial importance.The processes employed are carefully controlled and the final products are analyzed to determine their purity. When the work is completed, a careful detailed report of each process is made and discussed in class.

**470. Theoretical Chemistry**

*Preparation: 400, 410, 420*

In this course the more important principles of Theoretical Chemistry are considered; but these are treated with great thoroughness and are illustrated by applying them to a large variety of problems. The principles are further illustrated by lecture experiments. During the course the following subjects are considered: Pressure volume relations of gases and solutions, derivation of molecular and atomic weights, conductivity of solutions, ionic theory and mass action law, effect of temperature on chemical equilibrium, the laws of energy with reference to the production of heat and work, the electromotive force of voltaic cells and other electro-chemical topics.

**471. Theoretical Chemistry Laboratory**

This course comprises a series of exercises to give the student a knowledge of the methods employed in molecular weight determinations and in studying the important properties of solutions. Especial emphasis is laid on the underlying principles upon which all work of this character is based.

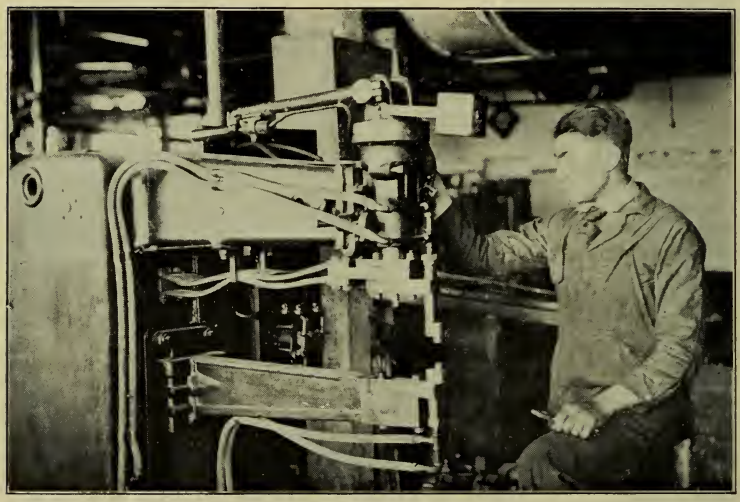
# Civil Engineering Students

Locating Walls of a Building
Aspinwall and Lincoln, Civil Engineers

Group of Civil Engineering Students

# Electrical Engineering Students

Winding Armatures
Armature Shop—Boston Elevated Railway Co.



Operating a Spot Welder
United Shoe Machinery Company—Beverly

**480. Experimental Problems**

This course is given ten hours per week during the second term of the fourth year. The time is devoted to the study of one or more problems of limited scope throughout original investigation. The problem may be chosen in inorganic, organic, or physical chemistry subject to the approval of the instructor in charge of the course. The object of this course is to give the student an opportunity for planning and carrying out research work and differs from a thesis simply in that the problem is less complex. A study of the literature of the subject to be investigated is an essential part of the course. A preliminary report of earlier work along the same lines with an outline of the experimental work to be undertaken is to be submitted before work in the laboratory is begun.

A conference of one hour per week is held with the work in the laboratory. Each student will be expected to make at least two reports on the problem with which he is working, the first of which will deal with his plan for the work and the later one with his results.

**485. Elementary Photography**

This is a brief lecture and laboratory course, intended to familiarize the student with the fundamental principles and operations of photography. The construction and operation of the more common types of plate and film cameras are explained, and a few representative plates, films, and printing papers discussed. The operations of exposing and developing are discussed in some detail, together with the making of positives, both upon paper and upon lantern slides. The laboratory work consists of taking, developing, and printing pictures under the supervision of the instructor. No previous knowledge of chemistry or photography is required. The course is given at the beginning of the second term, and is optional for any student in the School.

**490. German I**

This course is planned to give the student a knowledge of German grammar, as well as a working vocabulary of scientific terms. A study of grammatical forms, syntax and vo-

cabulary through composition exercises and rapid reading forms the basis of the work.

**491. German II**

*Preparation: 490*

A continuation of German I, in which the student is given full opportunity to extend his vocabulary of technical words, as well as to become familiar with technical books and scientific articles in the current German periodicals. The reading gradually becomes more difficult and considerable time is devoted to the syntax, idioms and synonyms of the language.

By the end of the course students should be able to read understandingly any ordinary article of a popular scientific nature, to understand spoken German and to express simple thoughts in German.

**500. Engineering Conferences**

An informal conference course of one hour per week, taken by every student in the School during the third and fourth years.

The purpose of this work is to discuss in class, under the direction of an instructor, the various duties in Engineering Practice which the students perform with the several co-operating firms. By this means, each student is enabled to profit by the work of the others, and they all are guided toward a broader viewpoint of their duties, and the relation of their individual work to that of the concern as a unit. Such subjects as problems in methods of manufacture, transportation, management, and distribution of charges, are all considered in this course.

**510. Engineering Practice**

This course covers the work in practical engineering which the student gets with his employing firm. The exact duties performed vary with the different courses, and also vary with the firm. The students receive grades in this work and the grades received are regularly noted on the report cards which are sent out.

**520. Summer Reading**

A summer course of reading has been established by vote of the Faculty in order to enable our students to become familiar with general and cultural subjects outside their special fields. For detailed information, including the lists of books recommended, see the special circular on Summer Reading, which may be obtained on application at the Dean's office.

# SUBJECTS OF INSTRUCTION

(Alphabetically arranged)

| SUBJECT | No. | Course | Year | Term | Hours | Preparation |
|---|---|---|---|---|---|---|
| Advanced Electricity | 370 | III | 4 | 1&2 | 2–2 | 340. 350 |
| Alternating Currents | 330 | III | 3 | 1&2 | 5–5 | 320 |
| Alternating Currents Laboratory | 331 | III | 3 | 1&2 | 6–3 | 330 |
| Alternating Current Machinery | 350 | III | 4 | 1&2 | 6–6 | 330 |
| Alternating Current Machinery Lab. | 351 | III | 4 | 1&2 | 6–3 | 350 |
| Applied Electricity | 310 | I, II, IV | 3 | 1&2 | 2–2 | 310 |
| Applied Electricity Laboratory | 311 | I, II, IV | 3 | 1&2 | 3–2 | 311 |
| Applied Mechanics | 200 | I, II, III, IV | 2 | 1&2 | 3–4½ | 12, 13, 20, 22 |
| Chemistry | 402 | I, II, III | 3 | 1st | 3–3 | ..... |
| Chemical Engineering | 460 | IV | 4 | 1&2 | 3–3 | ..... |
| Concrete Design | 151 | I | 4 | 1&2 | 3–0 | 150 |
| Concrete Structures | 150 | I | 4 | 1&2 | 2–2 | 101 |
| Descriptive Geometry I | 42 | I, II, III, IV | 1 | 1&2 | 4–1 | ..... |
| Descriptive Geometry II | 43 | I, II | 2 | 1&2 | 2–0 | 42 |
| Direct Current Machinery | 320 | III | 2 | 1&2 | 4–4 5–5 | 300 |
| Direct Current Machinery Lab. | 321 | III | 2 | 1&2 | 7–0 | 320 |
| Direct Current Testing Lab. | 322 | III | 3 | 1&2 | 6–3 | 321 |
| Electrical Measurements | 340 | III | 3 | 1&2 | 2–2 | 25, 300, 321 |
| Electrical Measurements Lab. | 341 | III | 3 | 1&2 | 3–3 | 340 |
| Elements of Electricity | 301 | I, II, IV | 2 | 1&2 | 2–2 | 10, 20 |
| Elements of Electrical Engineering. | 300 | III | 1 | 2nd | 3–3 | 10, 20, 400 |
| Engineering Conferences | 500 | I, II, III, IV | 3&4 | 1&2 | 1–0 | ..... |
| Engineering Laboratory | 250 | II, III | 4 | 1st | 2–2 | 230 |
| Engineering Practice | 510 | I, II, III, IV | 2<br>3, 4 | 1&2 | Outside Work | |
| English I | 1 | I, II, III, IV | 1 | 1&2 | 3–3 | ..... |
| Experimental Problems | 480 | IV | 4 | 2nd | 10–4 | ..... |
| Foundations | 165 | I | 4 | 2nd | 2–2 | 201 |
| Foundry Practice | 237 | II | 3 | 2nd | 1–0 | ..... |
| Gen. Trans. & Utilization of Power | 360 | III | 4 | 1&2 | 4–6 | ..... |
| Geology | 190 | I, II, III, IV | 3 | 2nd | 2–2 | ..... |
| German I | 490 | IV | 3 | 2nd | 3–3 | ..... |
| German II | 491 | IV | 4 | 1&2 | 3–3 | 490 |
| Heat Engineering | 230 | I, II, III, IV | 3 | 1&2 | 3–4½ | 12, 13, 201 |
| Highway Engineering | 112 | I | 3 | 1st | 2–2 | 110 |
| Hydraulics | 170 | I, II, III, IV | 3 | 1&2 | 2–3<br>3–4½ | 201 |
| Hydraulic Engineering | 174 | I | 4 | 1st | 3–3 | 170 |
| Industrial Chemistry | 450 | IV | 4 | 1&2 | 3–3 | 410, 420, 430, 440 |
| Industrial Chemistry Lab. | 451 | IV | 4 | 1&2 | 6–0 | 450 |
| Industrial Plants | 236 | II | 4 | 1&2 | 6–64–4 | 235 |
| Inorganic Chemistry | 400 | III, IV | 1 | 1&2 | 4–4 | ..... |
| Inorganic Chemistry Lab. | 401 | IV | 1 | 1&2 | 6–0 | ..... |
| Machine Designs, Statics and Dynamics | 225 | II | 4 | 1&2 | 9–6 | 201, 221, 230 |
| Machine Drawing | 221 | II, III, IV | 3, 2 | 1&2 | 9–0, 3–0<br>6–0 | 220 |
| Materials | 160 | I, II, III | 4 | 1st | 3–3 | 201 |
| Mechanical Drawing | 40 | I, II, III, IV | 1 | 1&2 | 6 or<br>9–0 | ..... |
| Mechanical Engineering Drawing | 220 | II, III, IV | 2 | 1st | 3, 6, 9–0 | 40, 210 |

* First term only.

| SUBJECT | No. | Course | Year | Term | Hours | Preparation |
|---|---|---|---|---|---|---|
| Mechanism | 210 | I, II, III, IV | 2 | 1st | 3–3 | ..... |
| Mathematics I a | 10 | I, II, III, IV | 1 | 1&2 | 6–6 | ..... |
| Mathematics I b | 11 | I, II, III, IV | 1 | 1&2 | 6–6 | ..... |
| Mathematics II a | 12 | I, II, III, IV | 2 | 1&2 | 5–5 | ..... |
| Mathematics II b | 13 | I, II, III, IV | 2 | 1&2 | 5–5 | ..... |
| Organic Chemistry I | 440 | IV | 3 | 1&2 | 3–3 | 420, 421 |
| Organic Chemistry I Lab. | 441 | IV | 3 | 1&2 | 6–0 | 440 |
| Organic Chemistry II | 442 | IV | 4 | 1&2 | 2–2 | 440 |
| Organic Chemistry II Lab. | 443 | IV | 4 | 1st | 6–0 | 442 |
| Physical Training | 50 | I, II, III, IV | 1&2 | 1&2 | 2–0 | ..... |
| Physics I | 20 | I, II, III, IV | 1 | 1&2 | 5–5 | ..... |
| Physics II | 22 | I, II, III, IV | 2 | 1&2 | 3–3 | 20 |
| Physics Laboratory | 23 | I, II, III, IV | 2 | 1&2 | 2–2 | 20, 22 |
| Plate Girder Design | 132 | I | 4 | 1st | 2–4 | 201, 130 |
| Power Plant Equipment | 235 | II | 3 | 1st | 2–1 | 230 |
| Precision of Measurements | 25 | II, III, IV | 2 | 2nd | 1–1 | 10, 11 |
| Qualitative Analysis | 410 | IV | 2 | 1&2 | 2–4 | 400, 401 |
| Qualitative Analysis Lab. | 411 | IV | 2 | 1&2 | 6–0 | 410 |
| Quantitative Analysis | 420 | IV | 3 | 1st | 2–4 | 410, 411 |
| Quantitative Analysis Lab. | 421 | IV | 3 | 1st | 6–0 | 420 |
| Railroad Curves | 110 | I | 3 | 1&2 | 3–4½ | 100, 101 |
| Railroad Earthwork | 110A | I | 3 | 2nd | 3–4½ | 110 |
| Railroad Fieldwork and Drawing | 111 | I | 3 | 1&2 | 6–0 | 110 |
| Sanitary Engineering | 180 | I | 4 | 2nd | 3–3 | 170, 174 |
| Standard Eng. Prod. & Proc. | 260 | II, III | 4 | 2nd | 3–4½ | 200 |
| Strength of Materials | 201 | I, II, III, IV | 3 | 1&2 | 3–4½ | 200 |
| Structural Design | 140 | I | 4 | 1&2 | 6–0 | 131, 132 |
| Structural Drawing | 120 | I | 2 | 2nd | 3–0 | ..... |
| Summer Reading | 520 | I, II, III, IV | 1, 2, 3 | | | ..... |
| Surveying I | 100 | I | 1 | 1&2 | 2–3 | 10, 11 |
| Surveying I, F. & P. | 101 | I | 1 | 1&2 | 6–0 | 100 |
| Surveying Field Work | 101A | II, III | 3 | 2nd | 3–0 | 4 weeks |
| Surveying II | 102 | I | 2 | 1&2 | 2–2 | 100, 101 |
| Surveying II Field Work & Plot | 103 | I | 2 | 1&2 | 6–0 | 102 |
| Technical Analysis | 430 | IV | 3 | 2nd | 2–4 | 420, 421 |
| Technical Analysis Lab. | 431 | IV | 3 | 2nd | 6–0 | 430 |
| Testing Materials Lab. | 255 | I, II, III | 4 | 2nd | 2–0 | 201 |
| Theoretical Chemistry | 470 | IV | 4 | 1&2 | 3–3 2–2 | 400, 410, 420 |
| Theoretical Chemistry Lab. | 471 | IV | 4 | 1st | 3–0 | ..... |
| Theory of Structures I | 130 | I | 3 | 2nd | 3–4½ | 201 |
| Theory of Structures II | 131 | I | 4 | 1&2 | 6–12 | 130 |

## REGISTER OF STUDENTS

### Enrolled During the School Year 1918-1919

| NAME. | COURSE. | HOME ADDRESS. |
|---|---|---|
| Abramson, Samuel | Ch. E. | *Roxbury* |
| Abromson, Harry P. | Ch. E. | *Cambridge* |
| Abromson, Onne | Ch. E. | *Cambridge* |
| Adams, Rollin P. | C. E. | *Brookline* |
| Akerman, Augustus E. | M. E. | *Dorchester* |
| Albert, Samuel | E. E. | *Beverly* |
| Allen, Earle C. | C. E. | *Holbrook* |
| Allen, Harold B. | C. E. | *Ayer* |
| Allen, Homer R. | C. E. | *Concord Junction* |
| Allen, Ralph E. | M. E. | *Belmont* |
| Alves, John J., Jr. | M. E. | *Provincetown* |
| Angeley, Richard M. | E. E. | *Abington* |
| Arnold, Harold P. | Ch. E. | *West Hanover* |
| Atkinson, Ralph L. | Ch. E. | *Dorchester* |
| Bailey, Percy W. | E. E. | *Kingston* |
| Baker, Chester P. | Ch. E. | *Brockton* |
| Baker, Clifford D. | M. E. | *Beverly* |
| Baker, David A. | M. E. | *Boston* |
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| Ballou, George D. | C. E. | *Dorchester* |
| Barry, Frederick L. | Ch. E. | *Holliston* |
| Bashian, Aram | C. E. | *Lexington* |
| Baxter, Charles E. | E. E. | *Dalton* |
| Beatey, Horace G. | Ch. E. | *Dorchester* |
| Beckwith, Roswell C. | Ch. E. | *Roslindale* |
| Behrens, Frank K. | E. E. | *Milford* |
| Belcher, Horace E. | E. E. | *Winthrop* |
| Bell, Thomas J. | E. E. | *Newburyport* |
| Belson, Abraham S. | C. E. | *Roxbury* |
| Bernard, Raymond M. | M. E. | *West Newton* |
| Bertelsen, Christian | E. E. | *East Boston* |
| Bertram, Herbert J. | E. E. | *South Boston* |
| Bessom, Ralph E. | M. E. | *East Lynn* |
| Blackwell, Lawrence F. | M. E. | *Plainville* |
| Blair, Allie C. | E. E. | *Montpelier, Vt.* |
| Blake, Donald R. | Ch. E. | *Wollaston* |
| Boyd, Thomas P. | M. E. | *Chelsea* |
| Boys, George W. | M. E. | *Killingly, Conn.* |
| Bradbury, Raymond J. | M. E. | *New Britain, Conn.* |
| Bradstreet, Raymond B. | Ch. E. | *Middleton* |
| Bray, Lewis E. | M. E. | *Everett* |
| Britchky, Hyman | Ch. E. | *Foxboro* |
| Brooks, Francis W. | M. E. | *Belmont* |
| Brown, Carl N. | C. E. | *Salem* |
| Brown, Leroy E. | C. E. | *Woodsville, N. H.* |
| Brown, Martin | M. E. | *Boston* |
| Brown, Ralph E. | E. E. | *Rockland* |
| Brown, Richard B., Jr. | E. E. | *Plymouth* |

| NAME. | COURSE. | HOME ADDRESS. |
|---|---|---|
| Brown, Percival O. | Ch. E. | *West Medford* |
| Brown, Phillip | Ch. E. | *Foxboro* |
| Burgess, Rosslyn F. | Ch. E. | *Atlantic* |
| Burhoe, Paul E. | E. E. | *Ashland* |
| Burton, Charles E. | C. E. | *South Ashfield* |
| Butterfield, Fisk H. | E. E. | *Ayer* |
| Calkin, Maynard S. | Ch. E. | *Somerville* |
| Callanan, Herbert A. | M. E. | *Danvers* |
| Cameron, Maurice | E. E. | *Cambridge* |
| Capen, Bernard H. | Ch. E. | *Stoughton* |
| Carbee, Charles F. | C. E. | *Dorchester* |
| Carl, James W. | M. E. | *Cambridge* |
| Carlsen, Fred H. | E. E. | *Gloucester* |
| Carter, Curtis S., Jr. | E. E. | *Haverhill* |
| Carter, Rupert A. | C. E. | *Haverhill* |
| Cavagnaro, Robert V. | E. E. | *Orient Heights* |
| Chase, Benjamin A. | E. E. | *Marblehead* |
| Chase, Charles S. | E. E. | *Leicester* |
| Chase, Chester R. | M. E. | *Wenham* |
| Cheney, Norman E. | M. E. | *Brockton* |
| Chinn, Pembroke B. | M. E. | *Boston* |
| Chopas, Harry P. | E. E. | *Roxbury* |
| Clarke, Kenneth O. | E. E. | *Kingston* |
| Clary, James M. | M. E. | *Beverly* |
| Clements, G. F. | C. E. | *Somerville* |
| Cloy, Robert C. | Ch. E. | *Roxbury* |
| Coakley, Bernard J. | M. E. | *Nahant* |
| Cohen, Hyman | C. E. | *Allston* |
| Colbert, Daniel H. | C. E. | *Marblehead* |
| Collier, Arthur M. | Ch. E. | *Salem* |
| Collins, Desmond M. | M. E. | *Boston* |
| Collins, Norman R. | M. E. | *Belmont* |
| Cone, James H. | E. E. | *Chester, Conn.* |
| Conkey, James O. | E. E. | *Hardwick* |
| Cook, Harold S. | C. E. | *Dorchester* |
| Cooke, Howard W. | E. E. | *Athol* |
| Coombs, Seldon P. | Ch.E. | *Medford* |
| Cowdrey, Harry S. | M. E. | *Auburndale* |
| Craddock, Herbert J. | C. E. | *Mayotown, Texas* |
| Cramer, George W. | C. E. | *Willimansett* |
| Cressy, Dustin G. | E. E. | *Bradford, N. H.* |
| Cronk, Ansel B. | C. E. | *Salem* |
| Crosby, Gordon J. | C. E. | *East Dedham* |
| Cundari, Frank A. | C. E. | *South Boston* |
| Currier, Roland E. | M. E. | *Tamworth, N. H.* |
| David, Harold E. | M. E. | *Amherst* |
| Davis, Stuart S. | E. E. | *Beverly* |
| Day, James H. | M. E. | *South Windham, Me.* |
| Dearborn, Elmore L. | C. E. | *Hampton, N. H.* |
| Delano, Ellis R. | M. E. | *Marshfield* |
| Dennis, Francis F. | C. E. | *Salem* |
| D'Espinosa, William J. | Ch. E. | *Norwood* |
| Dexter, Harold S. | M. E. | *Belfast, Me.* |
| Dickens, James, Jr. | M. E. | *Newburyport* |

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|---|---|---|
| Dietchman, Samuel | C. E. | *Boston* |
| Doane, Kendric P. | C. E. | *Groveland* |
| Dodge, Joseph N. | E. E. | *Boothbay, Me.* |
| Doliber, Irving E. | C. E. | *Marblehead* |
| Donnell, Richard S. | E. E. | *East Boston* |
| Dottridge, Ernest O., Jr. | M. E. | *Cotuit* |
| Douglas, Edward F. | E. E. | *Haverhill* |
| Dow, Clarence M. | C. E. | *Greenwood* |
| Downey, Ralph S. | M. E. | *Hingham* |
| Downing, George S. | Ch. E. | *Lynn* |
| Dubinsky, Louis | C. E. | *Waltham* |
| Dunn, Raymond L. | C. E. | *Lenox* |
| Durkee, Lester | M. E. | *South Hamilton* |
| Eagles, Lloyd N. | C. E. | *Harvard* |
| Eaton, Richard E. | M. E. | *Beverly* |
| Eiffe, Raymond J. | Ch. E. | *Salem* |
| Engstrom, Howard T. | Ch. E. | *Plymouth* |
| Enos, Henry B. | C. E. | *Dennisport* |
| Farley, Arthur W. | M. E. | *Salem* |
| Faunce, Lawrence S. | M. E. | *East Rochester, N. H.* |
| Fearing, Edward W. | M. E. | *South Weymouth* |
| Fernald, Sydney W. | M. E. | *Natick* |
| Field, William S. | E. E. | *Marlboro* |
| Finn, Charles A. | M. E. | *Holliston* |
| Fitzgerald, Edward | C. E. | *Boston* |
| Flagg, Walter E. | E. E. | *Wellesley* |
| Flock, Adolph M. | E. E. | *Roxbury* |
| Foran, William F. | C. E. | *West Newton* |
| Foss, August S. | Ch. E. | *Dorchester* |
| Foster, Frank M. | C. E. | *Roxbury* |
| Fowler, Albert E., Jr. | Ch. E. | *Newburyport* |
| Fox, Frank S. | E. E. | *Newburyport* |
| Frasheri, George D. | E. E. | *Boston* |
| Frawley, Thomas E. | C. E. | *Concord Junction* |
| Frolio, Samuel | Ch. E. | *North Wilmington* |
| Frye, Richard F. | M. E. | *Royalston* |
| Frazee, John E. | Ch. E. | *West Roxbury* |
| Fullerton, Albert L. | M. E. | *Roslindale* |
| Gaffey, Francis J. | C. E. | *Salem* |
| Gallagher, Edward J. | E. E. | *Atlantic* |
| Ginder, Chester J. | C. E. | *Everett* |
| Girard, Armand L. | E. E. | *Hudson* |
| Gladding, Richard S. | Ch. E. | *Beverly* |
| Goldstein, Joseph | M. E. | *Lynn* |
| Gordon, Morris J. | Ch. E. | *Boston* |
| Gould, Joseph E. | Ch. E. | *Boston* |
| Goulet, Narcisse T. | Ch. E. | *Pawtucket, R. I.* |
| Gove, Edwin W. | C. E. | *Beverly* |
| Greenberg, Edward | Ch. E. | *Dorchester* |
| Greenberg, Morris | Ch. E. | *Dorchester* |
| Griggs, John E. | C. E. | *Metcalf* |
| Gwinn, William A. | C. E. | *Beverly* |
| Gunther, Frederick E. | M. E. | *Roslindale* |
| Gustafson, George E. | M. E. | *Arlington* |

| NAME. | COURSE. | HOME ADDRESS. |
|---|---|---|
| Gustafson, Henry V. | Ch. E. | *Dorchester* |
| Haartz, Frederick H. | C. E. | *North Scituate* |
| Haddad, William W. | M. E. | *Worcester* |
| Hadjian, Sarkis | M. E. | *Boston* |
| Hale, Harold W. | C. E. | *Swansea* |
| Hall, Horatio V. | M. E. | *Hudson, N. H.* |
| Hall, Ralph P. | Ch. E. | *Medford* |
| Ham, George W., Jr. | M. E. | *Dorchester* |
| Hancock, Everett A. | Ch. E. | *Revere* |
| Harding, Arthur E. | C. E. | *Lynnfield* |
| Hartless, Robert B. | M. E. | *Boston* |
| Haswell, Percy D. | C. E. | *Danvers* |
| Hathaway, Chauncey D. | Ch. E. | *Dorchester* |
| Hawes, Arthur R. | Ch. E. | *Sudbury* |
| Hawkins, William H., Jr. | E. E. | *Dorchester* |
| Hayden, Leslie E. | Ch. E. | *Winthrop* |
| Hayes, Clifford R. | C. E. | *Waltham* |
| Heap, Edwin J. | Ch. E. | *Atlantic* |
| Heap, Sheldon S. | E. E. | *Atlantic* |
| Hendry, Herbert W. | E. E. | *Quincy* |
| Hendry, Irving S. | E. E. | *Roslindale* |
| Herrick, Edwin F. | M. E. | *Dorchester* |
| Hicks, Robert E. | E. E. | *Glen, N. H.* |
| Hills, Charles E., Jr. | E. E. | *South Natick* |
| Hochberg, Maurice S. N. | Ch. E. | *Dorchester* |
| Hodgkins, James P. | C. E. | *East Lynn* |
| Holland, Carl T. | E. E. | *Nantasket* |
| Holm, Alvin C | C. E. | *Gardner* |
| Holthaus, Frederick J. | E. E. | *Winthrop* |
| Houghton, Ralph A. | M. E. | *New Boston, N. H.* |
| Howard, Harold R. | E. E. | *South Boston* |
| Howard, Paul F. | C. E. | *Winthrop* |
| Howell, Charles E. | E. E. | *Watertown* |
| Howley, Joseph P. | E. E. | *Boston* |
| Hulsman, David L. | Ch. E. | *Everett* |
| Imberger, Francis F. | M. E. | *Jamaica Plain* |
| Ingalls, George A. | E. E. | *Danvers* |
| Ireland, Theodore S. | M. E. | *Gloucester* |
| Jackson, Harold G. | M. E. | *Somerville* |
| Jackson, Walter H. | C. E. | *Marlboro* |
| Johnson, George E. | M. E. | *Gorham, Maine* |
| Jones, Archibald L. | E. E. | *Middleton* |
| Junior, Francis E. | C. E. | *Plymouth* |
| Kaseta, John A. | E. E. | *Brockton* |
| Keenan, Maurice E. | M. E. | *Hartford, Conn.* |
| Kelleher, James J. | C. E. | *Salem* |
| Kelleher, John P. | M. E. | *Charlestown* |
| Kelley, Thomas G. | C. E. | *Roslindale* |
| Kennedy, Walter A. | E. E. | *Concord Juncton* |
| Kilborn, Henry R. | E. E. | *East Weymouth* |
| Kimball, Harry A. | Ch. E. | *Salem* |
| Klein, Walter J., Jr. | Ch. E. | *Natick* |
| Klumpp, Carl F. | Ch. E. | *South Boston* |
| Krantzmann, Isadore | C. E. | *Boston* |

| NAME. | COURSE. | HOME ADDRESS. |
|---|---|---|
| Kunberger, Arthur E. | Ch. E. | *Concord, N. H.* |
| LaBree, Frank H. | E. E. | *Dexter, Maine* |
| Lamprey, Carroll A. | M. E. | *Wolfeboro, N. H.* |
| Landry, Herbert A. | M. E. | *Norwood* |
| Landry, Thurba W. | E. E. | *Plymouth* |
| Lappin, Harry | Ch. E. | *Roxbury* |
| Larson, William C. | M. E. | *Worcester* |
| Lawler, George H. | E. E. | *Newburyport* |
| Lawler, Robert G. | M. E. | *Hartford, Conn.* |
| Leahy, James F. | Ch. E. | *Natick* |
| LeBaron, John C. | Ch. E. | *Middleboro* |
| LeClair, William B. | C. E. | *Waltham* |
| Lee, Israel A. | E. E. | *Salem* |
| Lee, Jasper R. | C. E. | *Orleans, Vt.* |
| Levin, Marney | C. E. | *Boston* |
| Levine, Philip | C. E. | *Chelsea* |
| Levine, Samuel | M. E. | *Roxbury* |
| Levitan, Abraham | Ch. E. | *Boston* |
| Lewis, Ralph F. | Ch. E. | *Provincetown* |
| Locke, Richard B. | C. E. | *South Boston* |
| Love, Gerald G. | C. E. | *Concord* |
| Lovejoy, Richard P. | Ch. E. | *Franklin* |
| Lyle, David J. | E. E. | *Gloucester* |
| MacWilliams, Harold F. | C. E. | *Newburyport* |
| Madden, Joseph N. | C. E. | *Salem* |
| Magovern, Dwight H. | C. E. | *Lunenberg* |
| Mallion, George A. | Ch. E. | *South Boston* |
| Maloney, Edward F. | Ch. E. | *Dorchester* |
| Manning, Arthur L. | M. E. | *Framingham* |
| Marcus, Jacob | Ch. E. | *Winthrop* |
| Marcus, Maurice | C. E. | *Dorchester* |
| Marinofsky, Joseph | M. E. | *Framingham* |
| Marrs, Purinton F. | Ch. E. | *Concord Junction* |
| Marsh, Charles C. | E. E. | *Newburyport* |
| Marshall, Chester S. | E. E. | *Greenwood* |
| Martell, Charles S. | E. E. | *Medford* |
| Matteson, William H. | E. E. | *Roslindale* |
| Maurer, Reginald A. | C. E. | *Brookline* |
| McCrossan, John M., Jr. | C. E. | *Fall River* |
| McGrath, Francis P. | M. E. | *Salem* |
| McKay, George E. | C. E. | *Dorchester* |
| McKenne, Charles D. | M. E. | *Everett* |
| McLatchy, John C. | E. E. | *Woburn* |
| Mead, Carl E. | M. E. | *Willimansett* |
| Medeiros, Dennis F. | C. E. | *Charlestown* |
| Meister, Norman A. | C. E. | *Sharon* |
| Millea, William W. | E. E. | *Salem* |
| Miller, Isadore O. | C. E. | *Chelsea* |
| Mills, Clifton W. | Ch. E. | *Boston* |
| Morgan, Stuart H. | Ch. E. | *Medford* |
| Moulton, Charles L. | C. E. | *Athol* |
| Nelson, Conrad J. | C. E. | *Beachmont* |
| Nelson, Frederick C. | Ch. E. | *Saugus* |
| Nelson, George H. | M. E. | *Boston* |

| NAME. | COURSE. | HOME ADDRESS. |
|---|---|---|
| Nickerson, Clarence W. | M. E. | *East Braintree* |
| Nickerson, Darius M. | C. E. | *West Harwich* |
| Nixon, Arthur | M. E. | *East Rochester, N. H.* |
| Noble, Robert A. | E. E. | *Rochester, Vt.* |
| Nolan, Joseph P. | E. E. | *Lowell* |
| Nylin, Carl G. | M. E. | *Worcester* |
| Nyman, Chester L. | C. E. | *Marlboro* |
| Ohrbom, Viking T. | C. E. | *Fitchburg* |
| Orman, Frank S. | C. E. | *Dorchester* |
| Packard, Clifford A. | Ch. E. | *Rockland* |
| Parad, Emanuel | M. E. | *Boston* |
| Parsons, Edward S. | C. E. | *Gloucester* |
| Pascoe, Thomas E. | C. E. | *Wolfeboro, N. H.* |
| Pastorino, Francesco | E. E. | *Turin, Italy* |
| Paver, William H., Jr. | M. E. | *Franklin* |
| Pearce, Howard T. | C. E. | *Gleasondale* |
| Pearson, Carl R. | C. E. | *Winthrop* |
| Peck, Warren H. | Ch. E. | *Plymouth* |
| Perkins, Theodore | M. E. | *Waltham* |
| Perry, Gilbert F. | C. E. | *Putnam, Conn.* |
| Perry, Norman W. | Ch. E. | *Wilmington* |
| Peters, Allen | Ch. E. | *Teaticket* |
| Peterson, Clarence A. | E. E. | *Everett* |
| Peterson, Vernon R. | M. E. | *North Abington* |
| Peterson, Waine | E. E. | *Gloucester* |
| Philpott, Arthur R. | E. E. | *Beverly* |
| Phipps, Chester D. | M. E. | *Holliston* |
| Pickard, Herbert P. | Ch. E. | *Concord Junction* |
| Pierce, Leon G. | E. E. | *Everett* |
| Pierce, Webster W. | Ch. E. | *Quincy* |
| Pierson, Bert F. | M. E. | *Rockland, Maine* |
| Pinkham, Arthur W. | M. E. | *Lynn* |
| Pinsky, Samuel M. | M. E. | *Medway* |
| Plakias, George A. | E. E. | *Winthrop* |
| Plummer, Walter W. | M. E. | *West Benton, Maine* |
| Powell, Harold R. | C. E. | *Allston* |
| Preble, Edwin G. | M. E. | *Beverly* |
| Rattray, William A. | E. E. | *Wakefield* |
| Read, Ellsworth W. | M. E. | *Belmont* |
| Redfield, Kendall A. | E. E. | *Lynn* |
| Rhoades, Clifford T. | C. E. | *Bridgewater* |
| Rice, Gordon A. | C. E. | *Jamaica Plain* |
| Rich, Luke A. | Ch. E. | *Newton* |
| Richards, Walter C. | C. E. | *Weymouth* |
| Richardson, Elmer H. | C. E. | *Reading* |
| Ricker, Karl P. | M. E. | *Danvers* |
| Robbins, Bertram B. | E. E. | *Elmwood* |
| Robbins, Percy A. | Ch. E. | *Bridgewater* |
| Robinson, Dexter T. | E. E. | *Roslindale* |
| Roscoe, Albert M. | Ch. E. | *Medford* |
| Rosen, Philip | Ch. E. | *Dorchester* |
| Rosenblatt, Irving | C. E. | *Saxonville* |
| Rounds, William J. | C. E. | *Boston* |
| Rowe, Lawrence V. | Ch. E. | *South Portland, Me.* |

| NAME. | COURSE. | HOME ADDRESS. |
|---|---|---|
| Sampson, Edward N. | E. E. | *Sharon* |
| Santis, Julius C. | C. E. | *Boston* |
| Sargent, Shaw D. | E. E. | *Newburyport* |
| Sawyer, Hall C. | M. E. | *South Windham, Me.* |
| Scanlan, James R. | M. E. | *Roslindale* |
| Schaller, William A. | Ch. E. | *Salem* |
| Seavey, Herbert T., Jr. | E. E. | *Stoughton* |
| Shea, Francis G. | C. E. | *Dorchester* |
| Sherman, Thomas E. | E. E. | *New Bedford* |
| Shopneck, Henry P. | Ch. E. | *Boston* |
| Siegel, Edward | Ch. E. | *Somerville* |
| Sigel, Israel | Ch. E. | *Revere* |
| Silverman, Joseph | Ch. E. | *Dorchester* |
| Smeltzer, Harold E. | E. E. | *Norwood* |
| Smith, John B. | C. E. | *Hyannisport* |
| Smithies, Arthur E. | E. E. | *Chester* |
| Sokol, Herman | C. E. | *Chelsea* |
| Soteriades, Evangelos | C. E. | *Wakefield* |
| Southwick, Rollin W. | M. E. | *Nahant* |
| Southworth, Burton | E. E. | *West Stoughton* |
| Spear, Roger E. | C. E. | *Winthrop* |
| Sperl, Warren | Ch. E. | *Auburndale* |
| Spofford, Stephen E. | E. E. | *Everett* |
| Sprague, Lawrence E. | Ch. E. | *Lynn* |
| Spurling, Kenneth T. | C. E. | *Newburyport* |
| Standley, David | C. E. | *Beverly* |
| Standtke, Max | C. E. | *Branderburg, Germany* |
| Staples, Merton T. | C. E. | *Danvers* |
| Sternberg, Simon | Ch. E. | *Boston* |
| Stewart, Arthur H. | M. E. | *Roxbury* |
| Stockwell, C. Lawrence | E. E. | *Randolph, Vt.* |
| Stowell, Preston D. | C. E. | *South Weymouth* |
| Strang, Paul S. | C. E. | *Allston* |
| Sugerman, Max H. | C. E. | *Lynn* |
| Sullivan, George J. | E. E. | *Roxbury* |
| Sullivan, Neal D. | M. E. | *Clinton* |
| Sullivan, William H. | M. E. | *Salem* |
| Swain, Kenneth F. | M. E. | *Swampscott* |
| Thomas, Raymond I. | E. E. | *Milford* |
| Thompson, Oscar F. | C. E. | *Norwood* |
| Toole, Cameron S. | C. E. | *Clinton* |
| Toomey, John W. | C. E. | *Beverly* |
| Trachtenberg, Frank | C. E. | *Dorchester* |
| Tucker, Harold A. | E. E. | *Fitchburg* |
| Tupper, Arthur A. | C. E. | *Greenwood* |
| Turner, Burton G. | C. E. | *Eastport, Me.* |
| Waldie, Peter M.* | Ch. E. | *Beverly* |
| Wallin, Carl G. | C. E. | *Allston* |
| Ward, Hubbard B. | M. E. | *Boston* |
| Wareham, William D. | C. E. | *Fall River* |
| Waugh, Leslie W. | E. E. | *East Boston* |
| Waugh, Stanley P. | Ch. E. | *East Boston* |
| Webb, Daniel I. | M. E. | *Boston* |
| Webber, George J. | E. E. | *Wilmington* |

| NAME. | COURSE | HOME ADDRESS. |
|---|---|---|
| Weekes, Donald | M. E. | *Belmont* |
| Weeman, Albert H. | M. E. | *South Windham, Me.* |
| Weinberg, Benjamin | C. E. | *Boston* |
| Werth, Lloyd L. | M. E. | *Rochester, N. Y.* |
| Wheeler, Ernest F. | M. E. | *Waltham* |
| White, Theodore A. | Ch. E. | *Abington* |
| White, Walter G. | E. E. | *West Ossipee, N. H.* |
| Whittemore, Preston C. | E. E. | *East Douglas* |
| Wilder, Everett P. | E. E. | *Hingham* |
| Wilkins, Henry M. | C. E. | *Marblehead* |
| Williams, Charles I. | E. E. | *Quincy* |
| Winiewicz, Charles M. | Ch. E. | *North Abington* |
| Wolk, Samuel | M. E. | *Waltham* |
| Woodbury, Robert O. | E. E. | *Beverly* |
| Wright, Moses E., Jr. | E. E. | *Newburyport* |
| Young, Henry B. | C. E. | *Brookline* |

## NORTHEASTERN COLLEGE
## CO-OPERATIVE SCHOOL OF ENGINEERING

*Boston, Mass.*.....19

*To the Dean:*

*(Name in full)*.....

*hereby respectfully applies for admission to the*.....

*Engineering Course of the Co-operative School of Engineering for the school year 19 19 , and submits the following data:*

*Name in Full*.....

*Residence*.....*City or Town*

*State*..... *Tel*.....

*Date of Birth*.....*Age*.....

*Parent's (father's) name*.....

*" " address* .....

*Graduate of*.....*High School. Year*.....

*If not a graduate, how many years were you in High School?*.....*When did you leave?*.....

*Why did you leave?*.....

*Name of principal*.....

*If employed since graduation, what is name of employer?* .....

*Employer's address* .....

*Names and addresses of two other persons, not ministers, to whom we may direct inquiries concerning you. (Give former employers, if possible.)*.....

.....

.....

.....

*Do you plan to complete the full four years' course?*.....

*Do you wish employment with a co-operating firm?*.....

*When do you wish to start practical work?*.....

*Where will you live during the school-year?*.....

*Weight*..... *Height*.....

*Have you any physical infirmities?*.....

*Is your general health good, fair, or poor?*.....

*Additional Remarks:* .....

.....

.....

## REMARKS

# NORTHEASTERN COLLEGE

## SCHOOL OF LAW

*Evening Sessions*

Established in 1898; incorporated in 1904. Provides a four years' course in preparation for the Bar, and grants the Degree of Bachelor of Laws.

## SCHOOL OF COMMERCE AND FINANCE

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## SCHOOL OF LIBERAL ARTS

*Evening Sessions*

Beginning with the fall of 1916, courses of college grade in English, Mathematics, Science, History, and Education have been offered. Professors and instructors of New England colleges have been engaged. These courses are open to graduates of high schools and to others who can meet the entrance requirements.

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*For further information concerning any of the above schools or departments, address*

**NORTHEASTERN COLLEGE**

**316 Huntington Avenue, Boston, Massachusetts**

# CO-OPERATIVE SCHOOL OF ENGINEERING

FOUNDED FOR THE INSTRUCTION OF MEN IN THE THEORY AND PRACTICE OF ENGINEERING